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For related information see also *Astronautics*.

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Includes information storage and retrieval technology; micrography; and library science.
For computer documentation see *61 Computer Programming and Software.*

83 ECONOMICS AND COST ANALYSIS 801
Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE 801
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 802
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences.*

88 SPACE SCIENCES (GENERAL) N.A.

89 ASTRONOMY 807
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 807
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 807
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance.* For space stations see *15 Launch Vehicles and Space Vehicles.*

92 SOLAR PHYSICS 808
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 808
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine.* For theory see *73 Nuclear and High-Energy Physics.*

GENERAL

99 GENERAL 809

Note: N.A. means that no abstracts were assigned to this category for this issue.

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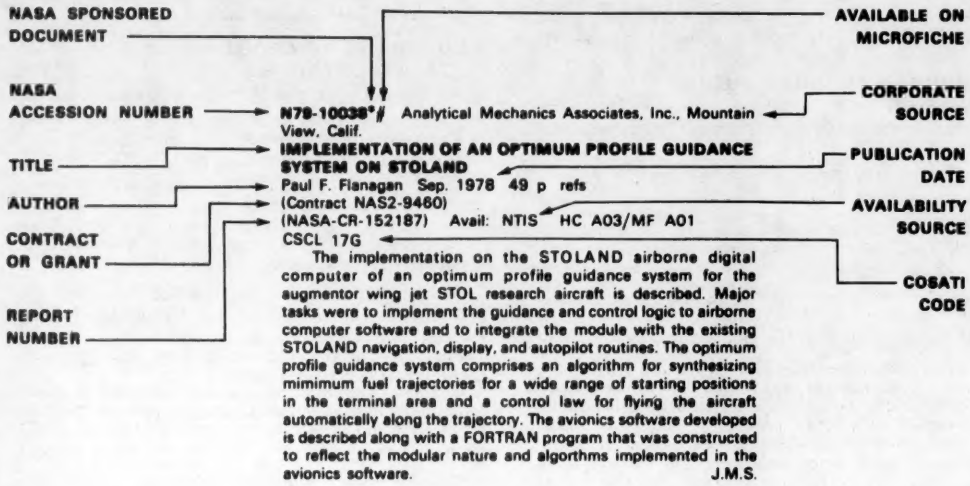
TYPICAL CITATION AND ABSTRACT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TITLE
IMPLEMENTATION OF AN OPTIMUM PROFILE GUIDANCE SYSTEM ON STOLAND
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The implementation on the STOLAND airborne digital computer of an optimum profile guidance system for the augmentor wing jet STOL research aircraft is described. Major tasks were to implement the guidance and control logic to airborne computer software and to integrate the module with the existing STOLAND navigation, display, and autopilot routines. The optimum profile guidance system comprises an algorithm for synthesizing mimimum fuel trajectories for a wide range of starting positions in the terminal area and a control law for flying the aircraft automatically along the trajectory. The avionics software developed is described along with a FORTRAN program that was constructed to reflect the modular nature and algorthms implemented in the avionics software.
J.M.S.

ON-GOING RESEARCH PROJECTS

This is a listing of research projects— not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, HIGH-SPEED EJECTORS

M. Alperin, Flight Dynamics Research Corp., *Burbank, California* (DF141080; F33615-77-C-3160)

An analysis of ejectors for possible applications at high speeds in the subsonic, transonic and supersonic range will be developed. Various relevant aero thermo fluid dynamic aspects will be introduced in the analysis in a systematic fashion so that realistic configurations can be designed. The analysis will derive ejector performance characteristics at conditions corresponding to flight environments of various altitude and speed ranges, so that ejector applications in a variety of Air Force systems such as aircraft, missiles, etc., can be investigated.

The analysis will include compressibility effects. Although the overall analysis will be based on one-dimensional calculations, two-dimensionalities will be accounted for in the considerations of losses arising due to skin friction, shocks, etc. The non-linear conservation equations will be solved iteratively.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0002, LOW-COST GRAPHITE/THERMOPLASTIC COMPOSITE STRUCTURES

W.F. Wennhold, General Dynamics Corp., Convair Division, *P.O. Box 80847, San Diego, California* 92138 (DN681286; N62269-75-C-0386)

To demonstrate and evaluate the cost savings attainable through design to low manufacturing cost by application of graphite-reinforced thermoplastic composites to representative aircraft structural components. The specific objective of this program is to extend the previous work under other contracts to the general area of stiffened, curved fuselage structural panels for advanced Navy aircraft. This work is in support of work unit ZA101, 'Aircraft Technology', Agency Accession No. DN 681080.

Test panels of representative construction suitable for use in the fuselage areas of advanced V/STOL aircraft will be designed, fabricated, and tested. Emphasis will be placed upon the post-forming of complicated shapes from flat stock and the fusion-joining of these shapes to flat and/or curved panels. Based on the results of these design and test tasks, a conceptual design study of a forward fuselage, utilizing all-composite construction, will be performed. The study will evaluate weight and projected production cost for typical advanced aircraft.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

1.0003, NONLINEAR FLUTTER

S.C. McIntosh, Nielsen Engineering & Research Inc., *850 Maude Ave., Mountain View, California* 94040 (DN890044; N00019-78-C-0118)

Investigate the influence of structural nonlinearities on the flutter of aerodynamic control surfaces.

A combined experimental/analytical study encompassing wind tunnel tests for simple aerodynamic sections which nonlinear torsional and plunging restraints together with theoretical predictions of limit cycle amplitudes and flutter speeds will be conducted. Correlations between calculated and measured results will be sought to identify the effectiveness and domains of applicability of the various analytical methods.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0004, IMPACT DAMAGE TOLERANCE OF THICK GRAPHITE/EPOXY LAMINATES

N.M. Bhatia, Northrop Corp., Aircraft Div, *3901 W. Broadway, Hawthorne, California* 90250 (DN881355; N62269-77-C-0401)

Aircraft structures are exposed to impact threats such as accidentally dropped tools, runway stones, and hail. In order to take full advantage of advanced composite materials in present and future Navy flight structures by a) allowing high-strain designs, b) insuring structural integrity of current designs through determination of critical damage and c) establishing proper inspection intervals, the impact resistance and post-impact damage tolerance of composites must be fully assessed. This contract supports work unit DG 602, Agency Accession No. DN 133126.

Conduct experiments to assess vulnerability of thick GR/EP laminates to low-velocity, hard-object impact and determine post-impact compressive fatigue strength.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

1.0005, HELICOPTER GROUND MOBILITY SYSTEM DESIGN AND FABRICATION - CONCEPT EVALUATION HARDWARE

R.W. Forsyth, Vehicle Systems Development Corp., *1251 W. 9th St., Upland, California* 91786 (DA0E3797; DAAJ02-77-C-0077)

Design, fabricate and initial test a highly mobile device which will move developmental (AAH and UTTAS) helicopters across rough, unimproved terrain for dispersal and maintenance purposes. A secondary objective is adapability of the system to skid-equipped helicopters.

Using specifications and drawings derived from prior year R and D efforts, perform detailed design, fabrication, assembly and check-out of concept evaluation hardware.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

1.0006, N42RF MAINTENANCE

J.D. McFadden, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Labs., *Boulder, Colorado* 80302 (8G172142)

PROJECT OBJECTIVE: Provide maintenance on WP-3 aircraft. Regularly scheduled checks; engine and prop changes; structural repair; tires; navigation and aircraft electronic systems; spare parts required to carry out maintenance procedures.

CURRENT YEAR PLAN: To maintain WP-3D in a high state of readiness for hurricane research and reconnaissance missions, oceanographic and air-sea interaction flights and fisheries research programs, through an intensive maintenance program

that includes daily and 200 hour inspections, engine performance, run-ups and aviation electronics and navigation systems flight tests.

PROGRESS REPORT: Normal maintenance and inspections were performed.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Labs.

1.0007, TRANSATLANTIC ROUTE PROCEEDING (CAB DOCKET 25908)
S.E. Robinson, Simat Helliesen & Eichner Inc., *1019 19th St. N.W., Washington, District of Columbia* 20036 (DOT-OS-60516/T.O. 04)

The purpose of this task order is to develop information regarding: (1) the level of operations and the number of carriers that the new markets for transatlantic flights (Atlanta, Cleveland, Dallas/Ft.Worth, Denver, Houston, Kansas City, Minneapolis/St. Paul, New Orleans, Pittsburgh, St. Louis and Tampa) could support; (2) the effect implementation of operations in these new markets would have on the distribution of traffic in existing markets. 1. Determine 1976 total traffic flows (including connections beyond London and beyond the U.S. point) by carrier in the following markets: Dallas/Ft. Worth-London; Houston-London; Atlanta-London. 2. Determine 1976 traffic flows (passengers and RPM's) in existing transatlantic markets (with particular emphasis on the U.K.) and estimate how these traffic flows would be impacted by the initiation of new services. 3. Project 1981 transatlantic traffic levels by carriers (U.S. and U.K.) for each of the markets under item 1 above and any impacted markets identified in item 2 above, assuming new transatlantic services identified above. This information will be used by DOT in regulatory evaluations within the U.S. Government and in bilateral consultation with the U.K.

SUPPORTED BY U.S. Dept. of Transportation, Office of the Secretary

1.0008, DEVELOPMENT OF AN ADVANCED STRUCTURAL INTEGRITY MONITORING SYSTEM (SIMS)
R. Onley, General Time Corp., Space & Div, *1200 Hicks Rd., Rolling Meadows, Illinois* 60008 (DN881380; N62269-77-TS-71218)

To develop a compact airborne system for monitoring 12 strain and other data necessary to evaluate the fatigue life expended in critical structural elements.

Using microprocessors and non-volatile memory chips, a small airborne recorder will be developed weighing not more than 12 lbs. The airborne unit will have a solid-state memory. A ground-based interrogator will be capable of putting 10 airplane-months of data on one cassette which will be forwarded to NADC for processing. The contract covers five recorders, one ground-based interrogator and a readout system.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

1.0009, NAVY ENVIRONMENT - STUDIES OF DELAYED FRACTURE MECHANISMS IN ALUMINUM ALLOYS USED IN NAVAL AIRCRAFT AND BOAT STRUCTURES
J.A. Green, Martin Marietta Corp., *1450 S. Rolling Rd., Baltimore, Maryland* 21227 (DN723866; N00014-74-C-0277)

The investigators seek to determine the causes and mechanisms responsible for delayed failure in many strength aluminum alloys used in naval structures when stressed in the marine environment.

The effect of microstructural and compositional variations on a macro- and micro-scale on the delayed fracture behavior of Al-Zn-Mg alloys is being studied. Structure and compositional variations are achieved by heat treatment and characterized by standard metallurgical techniques. Tensile fracture tests are conducted in various environments and fracture characteristics are correlated with structure and composition. A description of the mechanisms of delayed fracture in terms of variations in material, stress and environmental conditions is sought.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

1.0010, AUTOMATED AVIATION WEATHER FORECAST PROJECT - AVIATION WEATHER DESIGN STUDY TASK
R.G. Miller, U.S. Dept. of Commerce, Techniques Development Lab., *Silver Spring, Maryland* 20910 (AD5902)

TECHNICAL OBJECTIVE: 1. To examine methods to generalize the MOS approach by removing known limitations and constraints. 2. To select the most promising of three methods and propose a program for developing and testing in automated aviation forecasting applications. 3. To determine the feasibility of a software system which both develops and applies MOS equations in a real-time operation.

APPROACH: The work naturally divides into three main classes: 1. a systems analysis of the existing MOS processing requirements for both development and operational application (some reprogramming will be required to establish benchmarks for storage capacity and processing times), 2. developing a time-phased technique development programming plan which will guide the development effort under a follow-on contract, and 3. carrying out the plan.

PROGRESS: The generalized software required to carry out experiments is in final checkout status using output from a trial regression run and forecast program. Existing verification software is being modified to handle six-category forecast equations with 'best' category selected by threshold probability technique.

SUPPORTED BY U.S. Dept. of Defense, Air Force

1.0011, STRUCTURAL DESIGN OF HELICOPTER AND BALLISTIC SURVIVABILITY
D.F. Haskell, U.S. Dept. of Defense, Army, Armament Research & Development Command, Ballistics Modeling Div., *Aberdeen Proving Ground, Maryland* 21005 (DA0P4473)

To develop an analytical method for predicting the structural dynamic response of fragment-damaged line and panel composite elements subjected to blast loading.

An optimum structural design technique for helicopter survivability will be developed. Both undamaged and damaged line and panel composite elements will be modeled and their response to blast loading will be calculated. These line and panel elements will then be used to analytically build a composite helicopter primary structural component and study its structural dynamics behavior in the undamaged and damaged conditions.

SUPPORTED BY U.S. Dept. of Defense, Armament Research & Development Command, Ballistic Research Labs.

1.0012, GUST RESPONSE ALLEVIATION FOR A HINGELESS HELICOPTER ROTOR IN THE PRESENCE OF SINUSOIDAL VERTICAL GUSTS
E.A. Witmer, Massachusetts Inst. of Technology, School of Science, Dept. of Aeronautics & Astronautics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DN890068; N00019-77-C-0535)

Helicopters utilizing rotors with hingeless blades show great promise for future military and commercial applications. Much of the technology required for the development of such aircraft is available, but adequate understanding of the aero-elastic response of large flexible rotor blades to atmospheric turbulence has not yet been achieved. Such understanding is necessary during the preliminary design phase in evaluating the fatigue characteristics of the rotor and ride qualities of the vehicle, and, if necessary, in the development of suitable gust alleviation devices.

The contractor will perform a study of a wind-tunnel model of a three-bladed hingeless rotor in simulated cruising flight in the presence of sinusoidal vertical gusts. Methods of rotor blade gust alleviation will be studied. As a first step, criteria will be established by which various alleviation methods can be evaluated. With the help of the theoretical analyses, a rotor-blade-alleviation system will be designed and evaluated. The results of this investigation will determine the adequacy of the structural model and the utility of the analysis as a tool for designing rotor-blade-gust-alleviation systems. The contractor will correlate the experi-

mental model blade motions and stresses with theoretical predictions using the previously developed theory.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0013, BOLTED FIELD REPAIRS FOR COMPOSITE STRUCTURES

J. Watson, McDonnell Douglas Corp., *P.O. Box 516, St. Louis, Missouri* 63166 (DN881338; N62269-77-C-0366)

To develop and demonstrate field repair techniques using mechanical fasteners for composite monolithic wing skins generic to emerging Navy aircraft. To provide simplified composite repair methods which can be performed by organizational level personnel with minimal special training and logistic support. This work is in support of work unit ZA601 'Aircraft Technology', Agency Accession No. DN 681080.

Various designs for field repair of graphite/epoxy structures using mechanical fasteners will be investigated. Wing skin damage with through-the-thickness holes of up to 4 inch diameter in thicknesses of up to 1/2 inch will be investigated. The repair concept will be designed so that it can sustain a gross strain in the repaired area of more than 4000 micro in/in while restoring the original stiffness. Additional constraints such as access from the outside surface only, relaxed tolerances for field capabilities, minimal external protrusions, fuel containment and environmental considerations will also be considered in the design. Appropriate analysis will be performed to support the repair design concepts and will indicate sufficient safety margins for deviations in fabrication procedures due to field equipment and variability in workmanship and materials. An appropriate number of specimens will be fabricated and tested statically to evaluate the effectiveness of the selected repair designs.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

1.0014, FEASIBILITY DEMONSTRATION OF A RAFT SYSTEM

T. Pinelli, Air Cruisers Co., *P.O. Box 180, Belmar, New Jersey* 07719 (DN781462; N62269-76-C-0273)

Technical objective - demonstrate the feasibility of a helicopter installed system designed to provide deceleration during free fall, and subsequent flotation, of a high value cargo that has been intentionally jettisoned or inadvertently dropped during vertical replenishment operations over water. Automatic deployment of the system is planned to prevent specified levels of damage to the cargo upon impact with the water, to avert sinking and to facilitate recovery by surfaceship or helicopter. This contract supports work unit PH104, Agency Accession No. DN681034.

Approach - it is planned to conceive, analyze, and design a raft system, including its method of attachment, which is capable of meeting the objectives specified in statement of work SOW 3041-21; to fabricate feasibility test hardware, and to support NavAirDevCen personnel in subsequent flight tests.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

1.0015, ALTERNATE AIRCRAFT TAKEOFF SYSTEM FOR AIRCRAFT LAUNCH FROM BOMB-DAMAGED AIRFIELDS - CONCEPT DEVELOPMENT EFFORT 2

J. Forsyth, Bell Aerospace Co., *P.O. Box 1, Buffalo, New York* 14240 (DF140310; F33615-77-C-2100)

This effort is in support of research and development goals aimed at improving the readiness of Air Force aircraft to rapidly accomplish assigned missions. It is part of a program to develop an alternate aircraft takeoff system (AATS) for aircraft launch from bomb-damaged airfields. Presently, enemy-inflicted damage to paved runways can prohibit the rapid launch of aircraft to accomplish critical wartime missions. Thereby, an enemy can significantly increase its ability to successfully wage war. The objective of this effort is to develop and evaluate AATS concepts. Based on the results of this effort, the most promising AATS concepts will be selected for further development.

This work unit is for one of two separate concurrent contract efforts aimed at the initial development and evaluation of alternate aircraft takeoff system (AATS) concepts. Under each of these contracts, AATS subsystems will be defined, evaluated, and used to synthesize AATS concepts. Then, feasible concepts will be improved upon, evaluated and the most promising AATS concepts selected. Finally, the three most promising AATS concepts will be further developed, and a trade study performed to provide a sound basis for the selection of primary and alternate AATS concepts that will be further developed under follow-on in-house and contract work units.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0016, ADVANCED FUEL DELIVERY SYSTEM

R. Anderson, General Electric Co., Aircraft Engine Group, *1 Jimson Rd., Cincinnati, Ohio* 45215 (DN889779; N00140-78-C-0059)

The overall objective is to design, develop and demonstrate a lightweight, compact, contaminant-resistant fuel delivery system for use on advanced augmented gas turbine engines. This contract will supplement developments reported under DN596806 and DN796803.

The contractor will obtain a fuel contaminant-hardened vane pump/motor element to replace the gear-type element currently integrated into the unitized pump being developed and tested under contract N00140-75-C-0040. The element will be integrated into the unitized pump and will be bench-tested to confirm satisfactory performance. Tests will then be run to confirm the capability of the pump to operate with unfiltered contaminated fuel.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Propulsion Test Center

1.0017, THREE-DIMENSIONAL EFFECTS ON AUGMENTERS

W. Folex, Rockwell International Corp., *4300 E. 5th Ave., Columbus, Ohio* 43216 (DN881151; N62269-76-C-0402)

The purpose of this task is to conduct an investigation to determine the way separation develops in corners of thrust augmenter wings and modify the Stratford airfoil criterion to allow prediction of this corner separation as a function of pressures velocities and their gradients. This contract supports work unit ZA601, 'Aircraft Technology,' Agency Accession No. DN681080.

Hot-film surface sensors and pressure transducers are used to determine the exact mode of separation within the augmenter corner flow. Measurements of the pressure and velocity fields are made over a range of aspect ratios, end wall blowing, diffuser angles and primary pressures. The results are then correlated with a modified form of the Stratford criterion.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

1.0018, EVALUATION OF ADVANCED CRYOGENIC COOLER DESIGNS AND COMPONENTS

J.W. Ackerson, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF141580)

Long- and short-term problems for satellite aircraft and missile cryogenically cooled surveillance systems have been identified. Past developmental programs have shown a lack of understanding in cold finger dynamics, linear magnetic drive compressors, flexible lines, quick disconnects and cooler redundancies. The objective of this effort is to test and evaluate advanced hardware and concepts relative to the problems. The technology and data base derived from this effort could be transitioned into production programs in the AIM-9l and standard cooler projects and in the HALO technology program.

The work unit will be divided into four areas of testing. Test and evaluate performance of split system remote cold finger expanders. Test and evaluate a linear magnetic drive compressor concept for use with split system remote cold finger expanders. Life test various flex line concepts and materials for gimbal inter-

facing problems. Life test commercially available quick disconnects for gimbal interfacing problems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0019, ADVANCED INERTING TECHNIQUES

C.L. Anderson, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF141850)

It is imperative that the fuel tankage of combat aircraft be protected from fire and explosion that could result in the loss of aircraft. The objective of this program will be to evaluate nitrogen and halon 1301 in preventing fire and explosion in the ullage of aircraft fuel tankage. Ballistically proven inerting systems using nitrogen and halon 1301 have a significant weight savings over internal foam.

Phase I and II testing FY 77 has been completed with questions remaining concerning the effects inertants have on fuel tank sustained fires and the effects of non-worst case conditions on the inertant performance (specifically increased venting). The FY 78 and 79 program will be an extension of Phase I and investigate the effects of increased venting on inertant performance with emphasis placed on halon 1301. Testing will involve the use of a tank wall simulator similar to the Phase I specimen with provisions for venting as a variable. The specimen will be prepared in FY 78 and testing in FY 79.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0020, A/C FUEL TANK WALL RESPONSES TO HYDRODYNAMIC PRESSURES

S.J. Bless, University of Dayton, Graduate School, *300 College Park Ave., Dayton, Ohio* 45469 (DF140810; F33615-77-C-2082)

Combat survivability is a factor in developing an effective weapon system. A major cause of combat losses is the high vulnerability of aircraft fuel systems to nonnuclear threats. Aircraft fuel cells are susceptible to catastrophic fracture and rupture due to the intense pressure pulses immediately following impact by a ballistic projectile. The objective of this effort is (1) to develop a thorough understanding of the phenomenon (hydrodynamic ram) that causes this catastrophic damage and (2) to develop design criteria for combat-aircraft fuel-cells which can be used to inhibit or negate this damage, thus minimizing the vulnerability of the fuel tanks.

An analytical and experimental program will be conducted with a thorough analysis of each significant event beginning with projectile impact and continued as long as the resulting pressure pulses are intense enough to cause fuel-tank-wall catastrophic rupture/fracture/failure. Existing computer models will then be reviewed and/or modified for assessment methodology. Finally, the computer models will be used to develop families of design curves and design criteria which can be used to design aircraft fuel-tanks to inhibit or negate catastrophic failures resulting from the hydrodynamic ram phenomenon.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0021, ROTATING ARM RAIN EROSION TEST APPARATUS

G. Tatnall, U.S. Dept. of Defense, Navy, Naval Air Development Center, *Warminster, Pennsylvania* 18974 (DN781135)

Develop a Navy capability for research in the phenomenon of rain erosion damage and for qualification testing of materials and constructions in an erosion environment at subsonic and low supersonic velocities applicable to aircraft and missile systems.

The most cost-effective method for obtaining quantitative damage rate data is with the use of a rotating arm apparatus. Impact fracture velocity, erosion incubation times and erosion rate dependence upon rain intensity, velocity and impact angle can be established for predicting the life expectancy and repair level required for given radomes, metal coatings, elastomers, paint or metals.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0022, DYNAMIC FLIGHT SIMULATION OF V/STOL OPERATIONS DETERMINATION OF FEASIBILITY

E. Fessenden, U.S. Dept. of Defense, Navy, Naval Air Development Center, Crew Systems Dept., *Warminster, Pennsylvania* 18974 (DN681274)

To determine those acceleration conditions encountered in V/STOL operations that contribute to operator control problems. To assess specific problems of operator control and to determine the feasibility of dynamic flight simulation in studying the interactions of flight dynamic, sensory information and operator response characteristics in the control of V/STOL aircraft.

(1) Determine acceleration conditions encountered in V/STOL operations particularly during hover and transition phases of flight. (2) Conduct interviews, develop questionnaires, and consult technical/operational personnel regarding control problems encountered in V/STOL operations. (3) Conduct literature searches on the effects of accelerations determined above on the sensory/response characteristics of human operators. (4) Assess the feasibility of centrifuge dynamic flight simulation (open and closed loop) for investigation of the problem. (5) Conduct specific dynamic flight simulations of V/STOL operations. The thrust vector control will be added to an existing aircraft and available space will be reduced to conform to the smaller V/STOL aircraft. Our first effort will simulate motion only; however, the option of including additional displays such as HUD in the cockpit at a later date (when expanded computer capability is available) will be kept open. The cockpit will be V/STOL-dedicated.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

1.0023, FLUTTER CHARACTERISTICS OF A FLOATING TIP AILERON

L.B. Gwin, University of Texas, Austin Campus, School of Engineering, Dept. of Aerospace Engin & Engin Mech, *200 W. 21st, Austin, Texas* 78712

DESCRIPTION: The aeroelastic behavior of a free-floating wingtip aileron is investigated using a sequence of structural and aerodynamic models of increasing detail and complexity. This control device has the capability of significantly reducing wing bending moments during gust encounter, permitting larger planform and therefore greater efficiency and fuel economy. However, flutter problems have forced the termination of previous wind-tunnel testing.

SUPPORTED BY University of Texas

1.0024, ASSESSMENT OF OIL-WETTED COMPONENT DEBRIS DISCRIMINATING AND FILTRATION SYSTEM HT RM 78-04

Unknown, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Applied Technology Lab., *Fort Eustis, Newport News, Virginia* 23604 (DA0E3823)

Demonstrate ability of system modification to attain: (a) 30 percent reduction in the unscheduled removals brought about by poor diagnostics; (b) reduction in the current rate of false indications of current chip detectors (approximately 86 percent); (c) extension in the oil change interval on the engine from 100 hours to a minimum of 500 hours and 300 hours to 900 hours for the main transmission.

As presently structured, 40 UH-1 aircraft will be modified with high-efficiency, full-flow-through burn-off chip detectors and superfine filtration on the engines and main transmissions. In addition, the 42-degree and 90-degree gearboxes will also have burn-off chip detectors. The modified aircraft will be flown for one year and the data accumulated on system performance and oil life will be compared with a control group of 20 aircraft.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

1.0025, STOL AIRCRAFT VIBRATION CONTROL

C.S. Doherty, Boeing Co., *7555 E. Marginal Way S., Seattle, Washington* 98124 (DF139920; F33615-77-C-3035)

STOL aircraft vibration is expected to be substantially higher than for conventional aircraft, especially at low frequencies, due to the size, spacing, and exhaust impingement required of STOL engines. This environment could affect personnel and the reliability of all major sub-systems, and the low frequencies may render conventional vibration isolators ineffective. The objective of this work is to predict STOL aircraft vibration and to assess its impact on equipment and isolator design. The result could be new design and test requirements for stol aircraft equipment, revised handbooks and specifications, and a final payoff in increased system reliability.

The vibration induced by blown flaps of AMST prototypes will be studied and the resulting aircraft vibration will be predicted. The predictions will be confirmed and refined by comparison with measured AMST vibration to the extent that such data are available. The resulting interior vibration environment will be compared to present vibration design requirements, and methods for minimizing this vibration will be investigated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0026, ADVANCED FLIGHT CONTROL SYSTEM FOR PATROL AIRCRAFT (VPX) COMPUTER FEASIBILITY STUDY

W. Fields, Boeing Co., Boeing Aerospace Company, *7555 E. Marginal Way S., Seattle, Washington* 98124 (DN781383; N62269-76-C-0371)

Technical objective - to establish the requirements and configuration for an advanced VPX aircraft flight control system with the criteria of minimum redundancy for fail-operational performance.

Approach - a study to determine the feasibility of using a tactical mission computer as an element in a redundant flight control system was initiated. This contract supports work unit ZA601, Agency Accession No. DN681080.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

1.0027, INTEGRATED ENGINE EXHAUST NOZZLE

G.F. Goetz, Boeing Co., Boeing Aerospace, *7555 E. Marginal Way S., Seattle, Washington* 98124 (DN796806; N00140-76-C-1441)

To establish the performance of a 'two-dimensional' integrated engine nozzle reverser and vectoring system for an attack aircraft.

A study will be conducted to determine the thrust minus drag characteristics of the 2-D airframe integrated nozzle concept of a YF-17/18 wind-tunnel model.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Propulsion Test Center

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, MATERIALS SUPPORT TECHNOLOGY - LIQUID DROP IMPACT DAMAGE FOR CERAMIC MATERIALS

W.F. Adler, Effects Technology Inc., *Santa Barbara, California* 93105 (DN675494; N00014-76-C-0744)

The erosion of infrared sensor windows, infrared laser windows, and radomes exposed to rain, ice crystals and airborne dust and debris is a serious problem for all-weather subsonic and supersonic aircraft and missile systems. The objective of this basic research program is to investigate mechanisms of damage in crystalline inorganic materials for advanced aircraft and missile systems at impact velocities ranging from 100 to over 1,000 feet per second. This will provide rational directions for development of erosion-resistant materials via modification of microstructural features.

Work concentrates on damage produced by water drop impacts on surface defects, the influence of bulk material modifications on damage initiation and propagation, and materials removal mechanisms. Materials include MgF2, CaF2, MgO, Ge; all will be characterized before and after single drop and rain tests. Included are static and dynamic indentation resistance, fracture thresholds, surface finish, microstructure. Interactions of water drops with model defects are to be examined. Fracture mechanics analyses will be attempted. Descriptions of erosion kinetics will be developed. Damage modes are being correlated with materials properties.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0002, MATERIAL SUPPORT TECHNOLOGY - STUDY OF HETEROJUNCTION DISCONTINUITIES IN SEMICONDUCTORS

E.A. Kraut, Rockwell International Corp., Science Center, *2421 W. Hillcrest Ave., Thousand Oaks, California* 91320 (DN775015; N00014-76-C-1109)

Development of many new electron devices for Navy surveillance and communications electronics systems will require better understanding and control of heterojunctions in semiconductors. Theoretical and experimental studies of the electronic properties of semiconductor-semiconductor junctions will lead to new classes of devices and better understanding and control of devices already being studied by the DOD.

Using the tight binding method in the theory of the solid state, the electronic properties of the valence band discontinuity at the interface between two different semiconductors will be calculated. The model will consider atomic planes parallel to an abrupt junction using the LCAO method with wave functions as two-dimensional Bloch functions. Calculations will account for absolute energy scales as determined by atomic ionization potentials and the degree of covalent bonding in the semiconductors. The systems of interest involve the III-V compound semiconductors and the group IV elemental semiconductors. Abrupt junctions will be grown using molecular beam epitaxy. Measurements will be made in situ on thin films during growth using x-ray photoelectron spectroscopy. By using data from the chemical shifts it will be possible to extract information as to the changing chemical and electrical environment as a function of depth through the interface. In both phases of study, interface states and band bending will be considered.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0003, SEMI-ACTIVE CAMOUFLAGE FOR AIRCRAFT

F.H. Davis, U.S. Dept. of Defense, Navy, Naval Weapons Center, *China Lake, California* 93555 (DN782030)

To determine the feasibility of using fluorescent materials in a type of paint to simulate the sky in color and intensity. Ambient near-ultraviolet in daylight would be utilized to excite the fluorescence. The potential application would be in an aircraft coating which would blend with the sky background, greatly reducing the aircraft's detectability.

(1) Evaluate a variety of fluorescent materials in the laboratory using a double beam spectrofluorimeter. Present candidates are substituted anthracenes, coumarins, and quinolones. (2) Establish compatibility between selected dyes and paint vehicles. (3) Experimentally demonstrate that one or more compositions do, in fact, materially reduce the contrast of an object against the sky.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Weapons Center

3.0004, ENERGY DISPOSAL IN ELECTRONICALLY EXCITED HALOGEN ATOMS AND MOLECULAR OXYGEN

P.L. Houston, Cornell University, Ithaca Campus, School of Arts & Sciences, Dept. of Chemistry, *Ithaca, New York* 14850 (DF050520; AF-AFOSR-3513-78)

AF function - improved air operations in the functional areas of surveillance, reconnaissance, communications, command and control and weaponry require the development of more efficient visible and IR lasers. Deficiency - there is a lack of detailed knowledge of the production and lifetimes of metastable, elec-

tronically excited atoms and molecules. Objective - examine the deactivation of electronically excited halogen atoms and oxygen molecules in the presence of selected partners and determine the feasibility of these e to v deactivation processes as laser pumping mechanisms. How work contributes -deactivation by electronic-to-vibrational energy transfer can yield selected vibrational states of the collision partner. This scheme is identified as a possible pumping mechanism for new lasers.

Deactivation of i star and oxygen (singlet sigma) by e to v processes and by reactive collision will be examined by means of fluorescence detection. Total deactivation rates will be determined and efficiency and selectivity of the e to v or reactive process will be measured, and promising systems will be tested for laser action. Rates for the reverse v to e processes will also be available from the measurements.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0005, RADIATION EFFECTS ON INSULATORS USED ON ARTIFICIAL EARTH SATELLITES

J.A. Wall, U.S. Dept. of Defense, Air Force, Rome Air Development Center, *Griffiss Air Force Base, Rome, New York* 13441 (DF903610)

The objective of this work is to provide fundamental information on the effects of electrons, with energies corresponding to those encountered in the orbital region of the satellites, on insulating materials used in communications satellites.

There are three electron-insulator interaction phenomena relating to electrical breakdown that will be investigated. These phenomena are induced conductivity, secondary electron emission, and injected charge distribution. Literature searches will be performed in each of these areas to determine the current availability of data and its relevance to the satellite charging problem. Where data is needed, experiments will be performed to obtain the required information. These experiments will consist basically of irradiating the insulating materials with electrons of appropriate energies in a clean, oil-free vacuum and measuring the induced conductivity and secondary electron emission. Injected charge distribution will be determined theoretically. The information generated by these investigations will be combined to select and test insulator-conductor combinations that will minimize the probability of space-radiation induced electrical breakdown.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

3.0006, CONSOLIDATED PROPELLANT FOR TRAVELING CHARGE ROUNDS AND PHYSICAL AND COMBUSTION PROPERTIES THEREOF

L.R. Scott, Hercules Inc., *Magna, Utah* 84044 (DA0P4552; DAAK11 77 C 0031)

To prepare consolidated propellant samples for use in a 40-mm traveling charge gun. To characterize structural integrity, gas permeability and flame spread properties of the consolidated charges.

Selected single and double base propellants will be consolidated at various loading densities and their structural integrity, gas permeability, and flame spread properties determined. A special test fixture will be constructed to enable high speed cinematography of the flame spread process. Similarly, fixtures will be constructed for determining gas permeability and structural integrity. The samples and data to be generated by this program will support firing tests with a traveling charge gun at BRL.

SUPPORTED BY U.S. Dept. of Defense, Armament Research & Development Command, Ballistic Research Labs.

3.0007, THE DYNAMICS OF SOLID PROPELLANT COMBUSTION

L. Deluca, Politechnico di Milano, Instituto de Maccine, *Piazza Leonardo da Vince 32, Milan, Italy* (DA0D9384; DAERO 78 G0029)

Main objectives of the proposed research program are (1) to define the static and dynamic stability boundaries, and the pressure deflagration limits; (2) to investigate the existence, uniqueness and multiplicity of the equilibrium configurations; and (3) to locate the range of parameters allowing only self-sustained oscillation as regime solution.

The theoretical work will follow on the original guidelines developed by the principal investigator during the last few years. An approximate but standard integral method allows an ordinary differential equation formulation of the governing thermal diffusion problems in condensed phase with a quausi-steady gas phase. The structure of this nonlinear ordinary differential equation suggests the existence of critical points affecting both the static and dynamic stability of the propagating heterogeneous combustion wave. The experimental program is as follows: First year, dynamic extinction and pressure deflagration limit. Second year, upper, static and dynamic instability. Third year, self-sustained oscillations.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Research & Standardization Group

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, SOSTEL/GPMS INTERFACE UNIT

J. Gross, Sci Systems Inc., *8620 S. Memorial Pkwy., Huntsville, Alabama* 35802 (DN781229; N62269-76-C-0081)

To design and fabricate a SOSTEL III MUX/DEMUX terminal which will be integrated into a SOSTEL/GPMS interface unit and develop necessary software to allow communication between SOSTEL III and other avionics on the GPMS buses. This contract supports work unit ZA601, Agency Accession No. DN681080.

Adapt existing circuit designs to the physical limitations imposed by the configuration of the SOSTEL/GPMS interface unit. Develop electrical interface characteristics. Develop message structure in cooperation with avionics subsystem developers.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

4.0002, MANUFACTURE OF LITTLEJOHN SPIN ROCKET MOTORS

G. Webb, Thiokol Corp., *Huntsville, Alabama* 35807 (DA0G1039; DAAK40 76 C 0170 MOD 9)

Manufacture 15, TX-76 Littlejohn spin rocket motors, assemblies and igniters and deliver to Propulsion Directorate, Redstone Arsenal, Alabama.

SUPPORTED BY U.S. Dept. of Defense, Army, Missile Research & Development Command

4.0003, SUBMISSILE AEROBALLISTICS

W. Pettis, U.S. Dept. of Defense, Army, Missile Research & Development Command, Technology Lab., *Redstone Arsenal, Huntsville, Alabama* 35809 (DA0G1003)

This work is designed to meet the need for improved responsiveness and lethality against point and area targets. Successful applications of terminally guided submissiles require solution of aeroballistic problems associated with satisfactory deployment, dispersal, and compact airframe configurations with adequate stability, control, and maneuverability.

Exploratory analysis will be made of various aeroballistic problems associated with submissile dispersal. Critical problems include mutual interference between submissiles, between submissile and carrier vehicle, and between carrier vehicle and protective shrouds. An available deployment computer model will be studied. An experimental program will assess the various methods of testing submissile deployment and interference phenomena. Various testing techniques will be analyzed to determine which is the most effective for the phenomena investigated. these include sled tests, wind tunnel tests, and flight tests.

SUPPORTED BY U.S. Dept. of Defense, Missile Research & Development Command, Aeroballistics Directorate

4.0004, AIRCRAFT COCKPIT INFORMATION PROCESSING AND DISPLAY

D. Cohen, California Inst. of Technology, School of Engineering, Dept. of Engineering & Applied Science, *1201 E. California Blvd., Pasadena, California* 91109 (DN775186; N00014-77-C-0177)

This task, concerned with introducing advanced computing power and display techniques into the cockpits of high performance naval aircraft, has the ultimate objectives of effecting improvements in the way aircraft are handled, while increasing safety and efficiency and reducing pilot training costs. The goal is that of capitalizing on newly developed graphics display and miniaturized computational power to greatly reduce the routine effort of flying and to assist pilots in such important task areas as energy management and crisis recognition and management.

Contractor will review the literature on the state of the art in the relevant domains. He will communicate with Navy and Air Force, NASA, FAA and commercial airline personnel on the requirements for cockpit computation and display. Contractor will evaluate relevancy of recent technological developments to the cockpit problem, e.g., graphics, LSI techniques, portable large memory units. In parallel with the above, contractor will design experimental concepts and tools appropriate to assessing effectiveness of advanced concepts in the cockpit situation. Low-cost simulations of some of the proposed ideas will be conducted during this first year.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0005, PROTOTYPE HYDRAZINES ELECTROCHEMICAL ANALYZER

M. Shaw, Interscan Corp., *9614 Cozycroft Ave., Chatsworth, California* 91311 (DF323880; F33615-78-C-0607)

Survey monitors need to measure trace concentrations of the hydrazine rocket fuels in air to detect use area leaks and to protect personnel. Presently, available monitors lack portability, reliability and/or sensitivity. The state-of-the-art in electrochemical analyzers is now sufficiently advanced to provide the sensitive monitors needed at low cost. A portable hydrazine electrochemical analyzer shall be designed and built by the contractor.

The contractor shall design and build a portable hydrazine electrochemical cell that will provide sensitivity to better than 0.1 ppmv hydrazine, MMH and UDMH. Specificity will be maximized by selection of electrolyte, electrode system, composition, and potential and by air-electrolyte diffusion barrier membranes.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

4.0006, PLASMA SHEATH PROCESSES

C. Parazzoli, Northrop Corp., *3901 W. Broadway, Hawthorne, California* 90250 (DF461420; F33615-77-C-2048)

Develop microscopic theory of plasma processes in boundary and electrode regions of atmospheric electric discharge lasers and MHD power generators.

Utilize a kinetic analysis coupled with Maxwell's equations to examine sheath structure in boundary and electrode regions. Parameterize this analysis in an attempt to optimize discharge stability and laser efficiency.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0007, WIND-TUNNEL TEST OF LARGE-SCALE ROTOR HUBS (ANALYTICS AND EXPERIMENTAL INVESTIGATION OF THE AIRFLOW AND DRAG OF HELICOPTER HUBS AND PYLONS)

R.W. Prouty, Summa Corp., Hughes Helicopters Division, *Centinela Ave. & Teale St., Culver City, California* 90230 (DA0E3783; DAAJ02-77-C-0055)

To improve the complex, turbulent airflow around helicopter rotor hubs and pylons, which causes localized drag and vibration, and which generates a turbulent, energetic wake which strikes the tail rotor, fin and tail boom, causing further aerodynamic problems.

Design and analysis of alternative shapes for hubs and pylons, using two current representative designs (YAH-64 and UH-60A) as baseline designs; test of these shapes in the Langley V/STOL wind tunnel at speeds up to 170 knots, using models to one-quarter-scale and eight-tenths scale. Models will be heavily instrumented to measure pressure distributions, forces and moments, with flow visualization and wake surveys providing off-body aerodynamic parameters.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Air Mobility Research & Development Lab.

4.0008, COMMUNICATIONS - LOW-ENERGY PARTICLE DETECTOR

S.E. Deforest, University of California, San Diego Campus, Graduate School, Dept. of Physics, *P.O. Box 109, La Jolla, California* 92037 (DN775346; N00014-77-MP-0018)

Energetic charged particles in the earth's magnetosphere cause potentially damaging voltages to build up on spacecraft such as the planned Navy fleet SATCOM, and when precipitated into the ionosphere disrupt naval communications, navigation, and surveillance systems. Experimental measurements of the energies and pitch angle distribution of the charged particles are required to understand the spacecraft charging phenomenon, as well as wave particle interaction.

A particle detector to measure the energy and pitch angle distribution of proton and electron fluxes in the 1 ev to 70 kev energy range is being designed and tested for flight on the Air Force SCATHA spacecraft with a planned launch date early in 1979. Data from this detector will be used to define the properties of the ambient plasma and to infer charging potentials prior to and during periods of spacecraft charging, and will allow for the interpretation of the charging phenomena observed.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0009, SATELLITE TIME/FREQUENCY DISSEMINATION

D.W. Hanson, U.S. Dept. of Commerce, National Bureau of Standards, *325 S. Broadway, Boulder, Colorado* 80302 (2776119)

PROJECT OBJECTIVE: To develop the techniques and tools for transferring time and frequency information at all levels of accuracy and user sophistication. Included are the improved capability for national and international comparison of standards and time scales and the potential replacement of present WWV/WWVH broadcasts by satellite services.

PROJECT APPROACH: Experiments using satellites of opportunity will be conducted whenever possible and appropriate. The present experimental broadcasts of a time code from two of NOAA's GOES satellites will continue to provide a means of evaluating orbit prediction software, format content, modulation techniques, reception techniques, and user equipment designs. Economic studies, user surveys, and technical studies will be performed as appropriate to justify future permanent satellite services.

PRIOR YEAR ACCOMPLISHMENTS: Orbit determination software improved. Satellite controlled clock won IR-100 award, was exhibited at World Technology Fair (Chicago), and stimulated commercial versions. NBS/NOAA agreement signed to guarantee GOES time code for at least 5 years.

SUPPORTED BY U.S. Dept. of Commerce, National Bureau of Standards

4.0010, INSTRUCTIONAL SYSTEM DEVELOPMENT LOW-COST CONCEPT/DESIGN SPECIFICATIONS

P.W. Caro, Seville Research Corp., *Pensacola, Florida* 32505 (DN794034; N61339-77-M-0848)

This project is related to a current Naval Training Equipment Center training effectiveness improvement. This particular effort seeks new approaches to training and devices related to procedural learning.

SH-3 fleet readiness squadron operations are being analyzed to insure that conditions do not mitigate against use of procedural training and that application of research in other pilot training courses is feasible.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Training Equipment Center

4.0011, BOUNDS ON THE SOLUTION TO A UNIVERSAL KEPLER'S EQUATION

J.E. Prussing, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Aeronautical & Astronaut Engin, *2527 Hydrosystems Lab., Urbana, Illinois* 61801

Kepler's Equation is a transcendental equation relating position and time for a body in a conic orbit. Solving for the position at a specified time requires an iterative numerical solution. Previously obtained bounds on the solution are being generalized to the case in which the initial values are prescribed at an arbitrary point on the orbit. These bounds are derived for the universal formulation of the problem, which is uniformly valid for all types of conic orbits. The bounds obtained facilitate an iterative numerical solution by providing an accurate starting value for the iteration.

SUPPORTED BY University of Illinois

4.0012, AEROSOL FILTRATION BY FIBROUS FILTERS

T. Ariman, University of Notre Dame, School of Engineering, Dept. of Aerospace & Mech Engin, *Notre Dame, Indiana* 46556 (ENG77-09387)

A coordinated analytical and experimental research program will be conducted on fibrous filtration in an electrostatic field. The investigation will be based on a model fibrous filter with a staggered array arrangement of fibers. The major objective of the research is the development of the fundamental and predictive relationships for the collection efficiency as well as the pressure drop in fibrous filtration in an electrostatic field for the staggered-array fibrous filter model. In the experimental part of the research, a number of experiments will be performed using fibrous filters of uniform sized fibers and monodispersed aerosols in an electrostatic field and the fundamental relationships for the collection efficiency as well as the pressure drop will be evaluated.

Particles smaller than 3 microns aerodynamic diameter are the most difficult to collect with the available techniques and equipment. Unfortunately, fine particles also have a much greater impact on public health, visibility, and cloud nucleation when compared with the same weight of larger particles. It is expected that the outcome of the research will be utilized in the controlling of fine particles.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0013, REFRACTION/SCINTILLATION

R.K. Craine, Environmental Research & Technology Inc., *696 Virginia Rd., Concord, Massachusetts* 01742 (DF902510; F19628-77-C-0074)

AF radar and communications systems operating at low elevation angles are affected by the refractive index structure of the tropospheric propagation medium. Signal level, signal phase and pointing angles change on time scales ranging from seconds to months. Indications are that short-term fluctuations of one hour or less may exist of such magnitudes as to limit the usefulness of long-range correction models based on surface meteorological data, radiosondes, or radiometric measurements. Available data will be investigated and a future study program will be outlined.

Precision tracking data for orbiting spheres have been generated by the Millstone radar, which will be analyzed to determine instantaneous refraction errors in pointing, cross section, and phase versus elevation angle. This data plus scintillation measurements at the Haystack and Millstone sites will aid in the design of a measurement program for the LES 8/9 satellite system.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0014, IMPROVEMENT OF THE AMRL REMOTE OCULOMETER LINE-OF-SIGHT PERFORMANCE

J. Merchant, Honeywell Inc., *2 Forbes Rd., Lexington, Massachusetts* 02173 (DF322700; F33615-77-C-0517)

The objective of this contract shall be to improve the eye line-of-sight performance of the AMRL remote oculometer.

The AMRL remote oculometer measures eye line-of-sight by sensing the relative displacement, on a tv image, of the pupil of the eye and a corneal highlight reflection (for a fuller explanation, see Merchant, J., Morrissette, R., and Porterfield, J., 'Remote Measurement of Eye Direction Allowing Subject Motion over One Cubic Foot of Space,' IEEE Transactions on Biomedical Engineering, Vol. BME-21, No. 4, Jul 74). The accuracy and repeatability of the oculometer depends upon the algorithms used to determine the coordinates of the center of these two elements of eye detail. It is known that these algorithms are not optimum. Utilization of more of the available data would improve the signal-to-noise ratio of the pupil measurement and, hence, of the eye line-of-sight output. The contractor shall perform the following: (1) review the pupil and corneal algorithms to determine where potential for improvement of the accuracy and repeatability exists, (2) devise improved algorithms, and (3) implement these algorithms by modifying the AMRL remote oculometer program.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

4.0015, HOT ELECTRON INJECTION INTO GAAS AND RELATED MATERIALS 14813-P

D. Adler, Massachusetts Inst. of Technology, School of Engineering, Dept. of Electrical Engin, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DA0F9138; DAAG29-78-G-0035)

To understand and to describe theoretically by means of band models, the electronic transport between amorphous and crystalline materials of technological interest. Relevance - the research has potential relevance to the field of high speed microwave and optoelectronic devices. Injection of hot electrons directly into subsidiary conduction band minima of a technologically important material from a bistable emitter has potential for improving the efficiency of transferred electron devices.

The effects of hot electron injection from the on state of threshold-type chalcogenide glasses into III-V semiconductors will be studied. Wide band gap glasses will be used to inject electrons directly into subsidiary minima of the conduction bands in both n and p type crystalline semiconductors. I-V characteristics of the heterojunctions will be measured with and without presence of light. Band diagrams will be derived and tested. Electroluminescence and photoluminescence properties of the heterojunctions will be studied.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0016, UNSTEADY SHOCK WAVE MOTION IN TRANSONIC FLOW

T.C. Adamson, University of Michigan, Ann Arbor Campus, School of Engineering, Dept. of Aerospace Engineering, *Ann Arbor, Michigan* 48104 (DN790024; N00019-77-C-0263)

To study the unsteady motion of shock waves in two-dimensional transonic channel flow.

Computer solutions developed during the previous contract year will be used in making a short (one to two minutes) movie film illustrating unsteady flow with a shock wave in a two-dimensional symmetric channel; the unsteady behavior will arise as a result of oscillatory pressure pulses introduced in a plenum downstream of the shock wave. Next, the study of the characteristic time for the formation and collapse of a shock induced

separation bubble will be completed. Finally, an attempt will be made to use methods developed as a criterion for incipient separation induced by an oblique shock wave impinging on a flat plate turbulent boundary layer in transonic and in supersonic flow; the extent to which this analysis will be carried out will depend upon the time remaining after completion of the first two tasks.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0017, A STUDY OF SOME ELECTROMAGNETIC PROBLEMS RELATED TO EMP TECHNOLOGY

C.T. Tai, University of Michigan, Ann Arbor Campus, School of Engineering, Dept. of Electrical Engin, *Ann Arbor, Michigan* 48104 (DF050240; AF-AFOSR-3465-77)

AF function - electromagnetic sensors for aircraft are affected by structure on which they are mounted. This study seeks to quantitatively investigate the effect of the mounting structure on the sensor. Opportunity - the results of this study will provide important information essential in the design of aircraft antennae. Objective -the proposed research will elucidate the role of the singularity expansion method in the development of equivalent circuits for antennae and scatterers. Contribution - this investigation will provide a quantitative assessment of the effect of mounting structures on nearby sensors.

The study of equivalent circuits for antennae and scatterers will be approached as follows - (1) An investigation of the role of the entire function in the singularity expansion of the response function. (2) Obtain the complex natural oscillation frequencies of sections of loss-less and lossy uniform and non-uniform transmission lines terminated by known impedances. (3) Develop SEM equivalent circuits for cylindrical antennae and scatterers from their frequency domain responses. (4) Obtain experimentally appropriate frequency domain results for a conducting sphere. (5) Develop sem equivalent circuits for simplified aircraft models from their available frequency domain results.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0018, INP METAL CONTACTS

C.Y. Robinson, University of Minnesota, Minneapolis Campus, Graduate School, *322 Johnston Hall, Minneapolis, Minnesota* 55455 (DF903750; F19628-77-C-0204)

AF function - communications. Deficiency or opportunity - the properties of metal contacts on indium phosphide are inadequate and the mechanisms involved not well understood presently. Objectives - to develop an understanding of the electrical and metallurgical properties of the metal/InP system that will enable a superior contact to be formed. How research contributes - an understanding of the metal/InP interface will allow proper design of detectors operating beyond .94 microns for fiber optic communications systems.

Auger electron spectroscopy combined with barrier energy measurements, contact resistance measurements, and visual evaluation by scanning electron spectroscopy will be used to obtain metallurgical, chemical and electrical analysis of the metal/InP interface.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0019, THREE-DIMENSIONAL TRANSONIC FLOW ANALYSIS

F.W. Spaid, McDonnell Douglas Corp., *P.O. Box 516, St. Louis, Missouri* 63166 (DF043730; F44620-76-C-0096)

AF function - advanced aerospace vehicles. Opportunity - improved flowfield prediction methods in the transonic regime. Objective -develop a computational program which will permit calculation of steady, inviscid transonic flowfields around complex three-dimensional bodies. How work contributes - development of this technique will help reduce present requirement for extensive and expensive wind-tunnel testing.

The first phase of the development of computational method was accomplished. The full, steady transonic potential equation is used, with grid interpolation to allow application of exact boundary conditions on a curved surface embedded in a rectangular computation mesh. This follow-on method will provide extension of the program by incorporating a grid hierarchy to allow computations on a series of progressively finer grids and the ability to handle more complex configurations, including an arbitrary cylinder-nose profile, arbitrary wing-section distribution, and cylinder contouring.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0020, ADVANCED REMOTELY PILOTED VEHICLE AVIONICS SUPPORT

J.E. Bauer, U.S. Dept. of Defense, Navy, Ground Support Equipment Dept., *Lakehurst, New Jersey* 08733 (DN896002)

Develop support concepts and techniques for RPV avionics based on the determination of advanced RPV avionic characteristics.

Conduct studies to determine potential applications of RPV avionic systems, including operating environments, support requirements and physical and electrical characteristics. Analyze technology pertinent to RPV avionics support and determine new techniques to carry out the support function.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0021, ELECTRIC GENERATOR DEVELOPMENT FOR 1980

W. Uellner, U.S. Dept. of Defense, Navy, Naval Air Engineering Center, *Lakehurst, New Jersey* 08733 (DN696009)

To determine the approximate handling, servicing, maintenance and test systems and configurations as well as the associated cost requirements for existing and future aircraft electrical ground support equipment which will conform to the proposed revision of MIL-STD-704.

(a) Determine the specific operational support requirement. (b) Investigate the possibility of updating present inventory equipment and the associated data. (c) Investigate the technology, feasibility, and costs associated with new systems development to meet the new requirements. (d) Develop breadboard mock-ups of modified and/or new support system designs. (e) Evaluate these mock-ups and formulate recommendations for system development actions.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0022, NAVY VEHICLE DESIGN AND CONSTRUCTION - TRANSONIC ANALYSIS OF TWO-ELEMENT AIRFOILS

G. Volpe, Grumman Corp., Grumman Aerospace Corporation, *S. Oyster Bay Rd., Bethpage, New York* 11714 (DN575295; N00014-75-C-0722)

This research is directed towards developing a completely theoretical solution to the analysis and design of transonic two-element airfoil configuration. The use of such two-element airfoil configurations such as slats has improved performance of combat aircraft at transonic speeds where air-to-air combat usually occurs. However, the reasons for the effectiveness of slats or flaps at transnic speeds are not presently well understood and good slat or flap designs are experimentally arrived at through expensive wind tunnel test programs.

A three-phase program is being conducted. In Phase I an inviscid transonic analysis involving a merger of conformal mapping with a transonic mixed flow relaxation procedure will be developed. Phase II will develop a viscous flow analysis which will be incorporated into the Phase I inviscid transonic analysis program. The latest approach to shock wave-boundary layer interaction and trailing edge interactions will be included. Phase III will apply the above techniques towards developing an effective inverse method to determine airfoil shapes that are shock free at a given lift coefficient and free stream Mach number.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0023, NONLINEAR PHENOMENA IN ELECTROMAGNETIC THEORY AND ACOUSTICS 15017-M

J.B. Keller, New York University, School of Science & Engineering, Dept. of Electrical Engin, *Washington Sq., New York, New York* 10003 (DA0F9104; DAAG29-78-G-0002)

To systematically develop perturbation methods for nonlinear methods for nonlinear problems. Emphasis will be on the study of bifurcation and stability of periodic solutions. Relevance - the perturbation techniques to be developed will enable study of oscillatory behavior in electromagnetic and acoustical systems. Nonlinear wave theory will have specific applications to propagation in layered media, lasers and electrical circuits.

Perturbation methods will be used to obtain approximate description of nonlinear phenomena and derive qualitative properties of these systems.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0024, MULTICS REMOTE DATA ENTRY

R. Jackson, Pattern Analysis Recognition Corp., *310 E. Chestnut St., Rome, New York* 13440 (DF728900; F30602-77-C-0174)

The objective of this effort is to develop the capability for remote data entry into MULTICS OLPARS. OLPARS is an interactive graphics oriented system to aid in classification logic design and is available to remote users via access over the ARPA net.

An in-house analysis will be made to determine what hardware and software is needed to allow a user to enter data into the OLPARS filing system remotely. Cost factors, as well as ease of data entry, will be considered in determining what hardware will be used. The hardware and software will be implemented and then tested via the RADC ARPA net TIP.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0025, OPTIMIZATION OF SYSTEM DIAGNOSTIC AND FAULT ISOLATION PROCEDURES

T.J. Sheskin, Cleveland State University, School of Engineering, Dept. of Industrial Engin, *1983 E. 24th, Cleveland, Ohio* 44115 (DF051230; AF-AFOSR-3496-78)

AF function - to establish test procedures for the most cost-effective maintenance of complex electronic equipment, in aircraft and space vehicles and on the ground. Deficiency - because of their increased complexity and sophistication, modern electronic systems require large amounts of time and effort to repair and maintain. Some integrated circuits are so complicated that it is impossible to test all of their components or circuits. Objective - to design cost-effective diagnostic and fault isolation procedures for military electronic equipment. How work contributes - success in this research effort would result in faster and cheaper repairs or replacements, and therefore more reliable aircraft, weapons systems, and sensor and communications systems. In addition, the goal of automated diagnosis and reconfiguration would be brought nearer.

The plan is to investigate the use of optimization algorithms for the development of efficient, cost-effective diagnostic and fault isolation procedures. Such optimization tools will include dynamic programming, integer programming, and heuristic methods.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0026, THREE-DIMENSIONAL BOUNDARY LAYER COMPUTER PROGRAM

A. Martellucci, General Electric Co., *3198 Chestnut St., Philadelphia, Pennsylvania* 19101 (DF137360; F33615-77-C-3152)

Development work on new maneuvering reentry configurations has indicated an immediate requirement for additional analytical capability to compute viscous flow effects. It is desired to have a viscous code available within 6 to 9 months which can handle maneuvering vehicle configurations and hypersonic reentry conditions. The objective of this effort is to furnish program documentation for a three-dimensional viscous computer code of the boundary layer approximation class, deliver and demonstrate the program on the ASD computer system, and execute sample cases to verify overall program capability.

The General Electric Co. three-dimensional viscous code will be documented, including a complete description of the analysis and methods of solution. The program will be written in extended FORTRAN for the CDC 6600 and CYBER 74 computer systems and be compatible with the NOS/BE operating system in use at the ASD computer science center. Sample cases will be executed to verify overall program capability.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

4.0027, APPROXIMATION METHODS IN MULTIDIMENSIONAL FILTER DESIGN

N.K. Bose, University of Pittsburgh, School of Engineering & Applied Sciences, Dept. of Electrical Engin, *4200 5th Ave., Pittsburgh, Pennsylvania* 15260 (DF051090; AF-AFOSR-3542-78)

AF function - to design optimal cost-effective digital filters for radar, image processing, and telemetry systems. Deficiency - the advantages of digital signal processing are so compelling that the Air Force as well as commercial communications companies is gradually converting all communications to digital systems. The applications requiring two or more dimensions, such as video information, still contain some technological problem areas that prevent the economic usage of similar digital techniques. Objective - to advance the theory of approximation of functions of several variables by rational functions, in order to effectively design realizable filters that closely approximate the performance of a desired ideal performance. How work contributes - success in this research could lead to vastly improved digital circuitry for the various electronic systems used in aerospace vehicles and communications networks.

Approximation theory in one real variable makes use of the Haar condition, which does not hold in the more general situation. The plan is to study various schemes that can be devised to partly overcome this obstacle. The results of the approximation investigations will be applied to actual multidimensional filter design problems where the desired frequency response function is given.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0028, DESIGN, TESTING, AND EVALUATION OF AN ADVANCED TRANSONIC AIRFOIL WITH ACTIVE DIFFUSION CONTROL

C. Haight, Advanced Technology Center Inc., *P.O. Box 6144, Dallas, Texas* 75222 (DN881121; N62269-76-C-0318)

To carry out the design and wind tunnel demonstration of a fighter/attack-type airfoil that employs active diffusion control to obtain improved transonic cruise and/or maneuvering performance. This contract supports work unit NN701, Agency Accession No. DN481077.

Design goals for advanced fighter/attack aircraft will be developed for ATC transonic airfoil. Advanced computer design techniques will be utilized for the optimization of the airfoil pressure/geometry/blowing relationship. A second model will be fabricated and tested in the VSD-HSWT to cover a wide range of RN. Data will be analyzed to evaluate the design and its potential benefits.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

4.0029, PREDICTION OF STABILITY, CATASTROPHIES AND BIFURCATIONS OF ENGINEERING SYSTEMS

V. Szebehely, University of Texas, Austin Campus, School of Engineering, Dept. of Aerospace Engin & Engin Mech, *200 W. 21st, Austin, Texas* 78712

DESCRIPTION: Several discontinuous phenomena in engineering sciences are studied by the methods known as catastrophe theory or bifurcation analysis. Abrupt (discontinuous) changes in the behavior of the system are associated with the criti-

cal values of the force functions which dominate and influence the behavior of the system. Interesting examples studied are from economics, structural stability, from hydrodynamics and from orbital mechanics.

SUPPORTED BY University of Texas

4.0030, STABILITY OF GRAVITATIONAL SYSTEMS
V. Szebehely, University of Texas, Austin Campus, School of Engineering, Dept. of Aerospace Engin & Engin Mech, *200 W. 21st, Austin, Texas* 78712

DESCRIPTION: A quantitive evaluation of the stability and instability of systems in which gravity dominates. Rigid body motions, space vehicle attitude problems, gravitational three body problems, satellite and planetary stability, etc. are investigated using numerical and analytical methods.

SUPPORTED BY North Atlantic Treaty Org.

4.0031, HIGH-VOLTAGE SPECIFICATIONS AND TEST
W.G. Dunbar, Boeing Co., *7555 E. Marginal Way S., Seattle, Washington* 98124 (DF458680; F33615-77-C-2054)

To develop engineering criteria documents which will form the foundation for future military standards in the area of high-voltage/high-power (HV/HP) aircraft systems. This will assure that future HV/HP airborne equipments will meet mission requirements with adequate life, reliability, safety, and electromagnetic compatibility.

Pertinent, existing standards and specifications applicable to HV/HP requirements will be reviewed. These will be modified as required. New standards and test procedures will be developed as required. Corona detection equipment will be developed for the performance of tests at the High Power Laboratory, Wright-Patterson AFB OH. The developed engineering criteria documents and the test results will be distributed in draft format to vendors and other government agencies for review. Revisions shall be made as required and the documents will be incorporated in the final technical report.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0032, FIBER-OPTIC DIGITAL STATUS MONITORING DEVICES
Unknown, Boeing Co., Aerospace Div, *7555 E. Marginal Way S., Seattle, Washington* 98124 (DN590218; N00019-77-C-0039)

Development of low-cost fiber-optic digital status monitoring sensors for use in advanced aircraft systems.

Utilizing advanced optical techniques develop fiber optic sensors to measure temperature pressure, displacement, fuel level flow rate event counting and strain.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, OBSERVATIONS OF INDUCED ATMOSPHERIC OPTICAL EMISSIONS ASSOCIATED WITH BARIUM THERMITE RELEASES
G.J. Romick, University of Alaska, Fairbanks Campus, Geophysical Inst., *Fairbanks, Alaska* 99701 (ATM77-27103)

This grant funds observations seeking induced atmospheric optical emissions associated with barium thermite releases. Pulsating atmospheric emissions at 4278A and 5577A have been observed associated with barium releases in 1976 from the Poker Flat Research Rocket Range in Alaska. Another NASA-Goddard funded and planned series of four rockets with four Ba releases per rocket is now scheduled during the late morning hours at Poker Flat. Varying levels of activity are to be sampled by these releases to primarily investigate the electric field and neutral wind configuration during the late morning magnetic local time period (05/08 hours.) It is thought that the diffuse aurora is a requirement for the release to enhance or trigger auroral pulsations of the optical emissions; this rocket series should thus provide a significant opportunity to observe such enhancements and hopefully learn something about the mechanism of the enhancement as well as any implications relevant to natural auroral pulsations. This work is directed then at more closely investigating this phenomenon using an existing funded and planned Ba release program.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0002, CATALOG OF TERRESTRIAL IMPACT CRATERS, II. EUROPE, ASIA, AFRICA AND AUSTRALIA
M.J. Grolier, U.S. Dept. of the Interior, Geological Survey, Br of Astrogeologic Studies, *601 E. Cedar Ave., Flagstaff, Arizona* 86001 (8-9580-01469)

The catalog of terrestrial impact craters (Part I, North and South America; Part II, Europe, Asia, Africa and Australia) will record and illustrate all proven impact structures with a surface expression. Craters buried under a sedimentary cover are excluded from the catalog.

The intent is to assess the full range of terrestrial impact craters with respect to size, structure, stratigraphy, and to relate morphologic degradation to time and climate. The catalog should permit direct comparison of terrestrial impact craters with those of other planets.

The work plans calls for an updated bibliography, an index map, formatting of pertinent LANDSAT images, vertical aerial photographs, topographic and geologic maps, and a geologic summary for each crater. The catolog will be published in two parts: Part I, North and South America; Part II, Europe, Asia, Africa and Australia.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0003, DOCTORAL DISSERTATION RESEARCH IN EARTH SCIENCES
J.M. Guilbert, University of Arizona, School of Earth Sciences, Dept. of Geosciences, *Tucson, Arizona* 85721 (EAR78-01538)

This project involves doctoral dissertation research on the evolution of the younger Precambrian crust in Arizona. Preliminary evidence from a number of sources suggests that a convergent plate margin with island arcs similar to modern arcs was active during the Proterozoic Era from about 1.9 to about 1.4 billion years ago. The arcs and associated basins were accreted to the older Precambrian craton along structural trends oriented in northeast-southwest directions. The study will include field mapping, interpretation of colored aerial photographs, compilation of geochemical and chronological data from all available sources, and additional petrologic, whole-rock chemical, and isotopic analyses of selected samples. The project will provide details useful in projecting events in Proterozoic tectonic history into areas of central and northeastern North America where the record is partly obscured by cover of younger rocks or by younger metamorphism.

SUPPORTED BY U.S. National Science Foundation, Div. of Earth Sciences

5.0004, FOOTHILLS FAULT SYSTEM OF THE SIERRA NEVADA, CALIFORNIA
D.E. Stuartalexander, U.S. Dept. of the Interior, Geological Survey, Geologic Division, *345 Middlefield Rd., Menlo Park, California* 94025 (9540-02190)

STATE TO WHICH PROJECT PERTAINS: California.

In this fiscal year the lineament studies from LANDSAT, SLAR and U-2 color IR imagery will be completed. Field checking of the lineaments will be started, and in selective areas intensive efforts will be made to establish recency of faulting.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0005, DEVELOPMENT OF SOIL CRITERIA FOR LAND USE EVALUATION

M.J. Singer, University of California, Davis Campus, Agricultural Experiment Station, Dept. of Land Air & Water Resources, *Davis, California* 95616 (0067410; CA-D0-SPN-3196-H)

OBJECTIVE: Determine the usefulness of mechanical means of aerial photo interpretation. Correlate existing soil survey information with soil related problem in suburban areas. Determine appropriate criteria for predicting soil related problems in surburban areas. Improve capacity to predict problems in soils. Test validity of SCS interpretations of land use potential.

APPROACH: Use micro-densitometer to scan aerial photos. Use statistical techniques to determine usefulness of density slicing techniques for locating and mapping soil problem areas with special reference to salt affected soils using existing soil surveys as a basis. Use soil sampling and laboratory techniques to determine soil properties. Use statistical techniques to correlate soil related problems to soil properties and soil survey data. Use interviews to determine kinds and severity of soil related problems in suburban areas.

PROGRESS: Three areas of research are being pursued within this project. First, we are evaluating soil criteria used in the definition of prime agricultural land. We are using computer mapping techniques to compare different definitions and the soil components of the definitions. Second, we have concluded the study on properties of soils affecting their shrink-swell characteristics. The content of smectite and unidentified swelling smectite integrades is the major property responsible for high shrink-swell soils in the Sacramento Valley. Third, we are using a rainfall simulator to evaluate different soils as non-point sediment sources. We are evaluating the effectiveness of different vegetation and litter types as erosion retardents. This project interfaces with project 3199H. The relationship between percent cover and sediment in runoff water from the simulated rainstorms is Y(sediment) equals a-bx-cx , where a, b, and c are constants and x is percent (0-100) cover.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative State Research Service, California

5.0006, SEAREX - SEA AIR TRANSPORT-LASER ANALYSIS OF GAS PHASE METALS

E.D. Goldberg, University of California, San Diego Campus, Scripps Inst. of Oceanography, *P.O. Box 1529, La Jolla, California* 92038 (OCE77-23766)

SEAREX is a multi-disciplinary, team-managed project aimed at understanding material transport between the atmosphere and sea surface of the major oceans. Particulate matter in air is trapped in tower-mounted collectors on two mid-Pacific islands near the equator. Material leaving the sea surface as bubble-induced spray and by evaporation is also collected. Analysis of this material for stable metals, radiochemicals, and organic matter is combined with measurements of accumulation rates to assess flux of major classes of pollutants. Results of this study will provide some of the basis for global models describing how pollutants interact with the oceans.

This award supports the development of a laser resonance fluorometer for analyzing metal species in the atmosphere. The low concentrations detectable by this instrument will assess metal fluxes from sources important to baseline inputs such as rocks, seawater, forests, and volcanoes. Previous samplings have not taken these sources into account though they may be very important to overall ocean-atmosphere interactions.

SUPPORTED BY U.S. National Science Foundation, Div. of Ocean Sciences

5.0007, REMOTE SENSING STUDIES

J.R. Apel, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Labs., *Boulder, Colorado* 80302 (87130228)

OBJECTIVE: Conduct research into such aspects of the ocean and atmospheric boundary layers as may be carried out using techniques of remote or indirect sensing of environmental parameters in combination with classical in situ measurements. Provide a center of expertise in the remote sensing disciplines; work jointly with other PMEL groups in field investigations and develops new techniques for indirect measurement of environmental parameters.

CURRENT YEAR PLAN: Begin work on NIMBUS-G, support field data experiment in Gulf of Mexico.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Labs.

5.0008, SEASAT - ALASKA CRUISE

H.M. Byrne, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Labs., *Boulder, Colorado* 80302 (8B326128)

PROJECT OBJECTIVE: Secure sea truth verification data for the SEASAT satellite during 1-month cruise; analyze the data and produce a report on the quality of data drawn from the SEASAT sensors.

CURRENT YEAR PLAN: Sponsor a major (30-day) seagoing exercise to gather oceanographic data in support of SEASAT program; analyze the data and prepare a report of its applicability to NOAA objectives.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Labs.

5.0009, LIDAR WIND MEASURING SYSTEM

P. Mandics, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Labs., *Boulder, Colorado* 80302 (RAA7 42 24)

PROJECT OBJECTIVE: Study the feasibility of a satellite-borne coherent pulse lidar system to measure global atmospheric winds.

CURRENT YEAR PLAN: Study atmospheric effects (turbulence, attenuation, etc.) on lidar system performance. Perform computer simulations to evaluate expected system capabilities. Test existing ground-based lidar systems.

PROGRESS REPORT: The Phase I study effort was completed in April, 1978. Feasibility of measuring the global wind field was indicated. A more detailed analysis will be performed in this part of the study. A more accurate computer simulation will be developed. More representative two- and three-dimensional wind fields will be utilized in the study.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Labs.

5.0010, RESEARCH AIRBORNE

F.C. Frischknecht, U.S. Dept. of the Interior, Geological Survey, Geologic Division, *Box 25046, Denver Federal Center, Denver, Colorado* 80225 (9780-00353)

Scale model studies will be carried out for targets located beneath an inhomogeneous overburden.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0011, SOUTH TEXAS LINEAMENTS

E.R. Verbeek, U.S. Dept. of the Interior, Geological Survey, Br of Central Environ Geology, *Box 25046, Denver Federal Center, Denver, Colorado* 80225 (9530-01609)

States to which project pertains: Texas.

Two demonstration maps of active faults in the Houston metropolitan area, where the effects of continuing fault motion are most detrimental, will be completed this year. Delineation of those areas where fault damage is, or likely will be, most severe may be of use in plans for future development of the city.

A partial history of faulting within the area will be reconstructed from older (pre-1940) aerial photographs and early detailed topographic maps, supplemented by accounts of fault damage from long-term residents. The history of faulting, when compared to the history of fluid production in the area, will test the inference that pressure declines due to pumping from subjacent strata are in some way stimulating fault motion.

Continuing studies involve methods of fault identification, the relationship of surface faults to both regional growth faults and faults associated with salt diapirism, and determination of patterns and densities of faults displacing Quaternary sediments in the Texas Gulf Coast.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0012, RESEARCH ON SEA SPECTRA ANALYSIS TECHNOLOGY - TARGET SURVEILLANCE AND ENVIRONMENTAL SUPPORT TECHNOLOGY FOR WAVEHEIGHT MEASUREMENT

D. Stilwell, U.S. Dept. of Defense, Navy, Naval Research Lab., *Washington, District of Columbia* 20375 (DN680027)

The objective of this program is to further analyze the remote sensing capabilities of the sea photo analysis technique. The technique is being researched to a degree where it may be used routinely to sense and measure the state of the ocean surface spectral fluctuations under a wide range of conditions. Success in this effort will result in a new naval method for the determination of major ocean descriptors, which can have a decided impact on naval sensors and systems; e.g., the detection of small targets on the ocean and sensing area extensive but small perturbations of ocean surface features.

Sea photo analysis techniques are being applied in the areas of target detection and real-time sea state determinations. The present limitations of sea photo analysis, viz. high obliquity, perspective distortion, long wavelength suppression, and wave sensitivity inaccuracies will be studied and means for alleviating them investigated.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

5.0013, NUMERICAL AND THEORETICAL RESEARCH ON THE SOMALI CURRENT

D.F. Strobel, U.S. Dept. of Defense, Navy, Naval Research Lab., *Washington, District of Columbia* 20375 (DN680113)

To model and understand the dynamics of consistently observed features of the Somali current. This study will form an important part of the more general numerical studies of mesoscale, one-basin and global ocean circulations. These models will be used to forecast upper ocean layer environment from observational data, including satellites.

The general approach will be to solve numerically the equations of hydrodynamics and thermodynamics relevant to the Indian Ocean on large digital computers. The techniques employed (e.g., finite differences, stretched grids, etc.) will be specifically tailored to the Somali current region and the monsoon time scale. The model will use a semi-implicit two-layer hydrodynamical-thermodynamical model with variable coastline, bottom topography, stretched grids, vertical mixing, and solar insolation. Special attention will be paid to the role of upwelling and meridional heat transport.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0014, SYSTEMATIC ANALYSIS OF ISIS 1 AND 2 LOW-ENERGY AURORAL PROTONS

J.R. Sharber, Florida Inst. of Technology, School of Science & Engineering, Dept. of Physics, *Country Club Rd., Melbourne, Florida* 32901 (ATM77-15257)

Soft particle spectrometers on the polar orbiting satellites ISIS 1 and ISIS 2 measure the differential energy spectra of precipitating auroral electrons and protons over the energy range 10 ev to 13 kev. This grant will support a systematic analysis of approximately 2 1/2 years of ISIS proton data accumulated through 1972 which will define the variation of the proton energy spectrum, intensity, and angular distribution with geomagnetic latitude, magnetic local time, and substorm phase. Results obtained for the proton population will be compared with the better known features of the electron population. The investigation will provide a more thorough understanding of particle acceleration within the magnetosphere and over the auroral ionosphere. With its emphasis on the substorm phase, it should also provide a more complete description and understanding of the substorm process, a process which still lacks full explanation.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0015, NORTH PACIFIC EXPERIMENT (NORPAX) - LAGRANGIAN CURRENT MEASUREMENTS FOR PHASE I OF THE NORPAX EQUATORIAL PROGRAM

D. Hansen, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Labs., Atlantic Oceanic & Meteorological Labs., *15 Rickenbacker Cswy., Miami, Florida* 33149 (OCE77-16827)

This project is part of the North Pacific Experiment (NORPAX). The long-range goals of NORPAX are to understand fluctuations in the upper layers of the Pacific Ocean with time scales of months to years and space scales in excess of 1,000 kilometers and to determine the relationship of these oceanographic fluctuations to the overlying and adjoining atmosphere. Achievement of these goals should eventually lead to improved weather/climate prediction for the Equatorial Pacific Ocean and the American continents.

As part of the NORPAX Equatorial Program in the winter of 1977-78 this project will deploy four drifting buoys on each of three transits of a research vessel across the Equatorial Pacific Current System. The buoys will be equipped with drogues so that they will approximately follow the water in the upper layers of the ocean. The trajectories of the drifting buoys will be monitored by the RAMS position fixing system aboard the NIMBUS-6 satellite. In addition to giving information on currents, three of the buoys will support chains of temperature sensors to observe the depth of the warm layer. The principal objectives of this project are to obtain information on the spatial structure of surface currents in the region of the Equatorial Countercurrent and to help interpret other physical oceanographic measurements which will be taken by other NORPAX scientists at the same time.

SUPPORTED BY U.S. National Science Foundation, Div. of Ocean Sciences

5.0016, CHEMISTRY OF MANTLE MINERALS

J.V. Smith, University of Chicago, Graduate School, Dept. of Geophysical Sciences, *5801 S. Ellis Ave., Chicago, Illinois* 60637 (EAR76-03604)

This project concerns the petrology and geochemistry of kimberlites, garnet peridotites, Archean metamorphic and certain lunar rocks. Emphasis will be placed on kimberlites and garnet peridotites. This research is a continuation of a study of major and trace element distribution among co-existing minerals in these rocks by electron microprobe methods and the initiation of their analysis by the microprobe. The ion microprobe has a very high sensitivity and will thus allow an analysis of elements not yet determined in these rocks. In adddition, the ion microprobe will provide isotopic data for the elements determined. The higher sensitivity and isotopic analyses will enable a more detailed evaluation of the conditions under which these rocks formed and - of particular importance - may provide evidence about the migration of volatile elements in the mantle.

SUPPORTED BY U.S. National Science Foundation, Div. of Earth Sciences

5.0017, PHYSIOGRAPHIC CLASSIFICATION OF SOUTHERN PINE FOREST LANDS

N.E. Linnartz, Louisiana State University, Agricultural & Mechanical College, School of Forestry & Wildlife Management, *University Station, Baton Rouge, Louisiana* 70803 (0060824; LAB01574)

OBJECTIVE: Organize physiographic land patterns into a system having significance and utility for resource managers. Develop a physiographic map of southern region using the new system.

APPROACH: Current information on physiography, spoils, and surface geology related to forest vegetation will be analyzed and coordinated. Localized information will be reorganized to

form a unified regional system. Map development will be on a state basis, utilizing local authorities, aerial photography, and space imagery when appropriate.

PROGRESS: The S-84 Technical Committee met July 1976, to review research progress. Committee Chairman distributed copies of the published map 'Forest Habitat Regions from Satellite Imagery: States of Alabama and Mississippi' which is a supplement to the soon-to-be-published South. Coop. Series Bull. 210: 'Forest Habitat Regions and Types on a Photomorphic-Physiographic Basis: States of Alabama and Mississippi.' A geologic map of Louisiana has been submitted to complete the file of background material needed to develop a similar map and bulletin for Louisiana, which may be one of the last states to be completed.

SUPPORTED BY Louisiana State Government

5.0018, FOREST DAMAGE ASSESSMENT USING REMOTE SENSING

M.D. Ashley, University of Maine, Orono Campus, School of Forest Resources, Mcintire Stennis Program, *302 Boardman Hall, Orono, Maine* 04473 (0065683; ME09607)

OBJECTIVE: Aerial photography, multispectral scanner and image enhancement remote sensing systems will be evaluated to find if it is possible through the use of these remote sensors to: Detect areas of new budworm attack earlier than with present methods. Identify forests requiring spraying or other control measures to prevent excessive tree mortality and timber loss from budworm attack more efficiently than with present methodology. Assess the degree of recovery of forest stands after spraying. Determine the location and amount of mortality caused by the spruce budworm.

APPROACH: Data collected from field and laboratory studies of remote sensing imagery will be evaluated to find how well budworm damage can be assessed using such imagery. Different film-types, scales of photography and the multispectral scanner imagery will be obtained in mid-summer (maximum browning), late fall and early winter. The aerial photography and field work will be initiated in July 1974 in the spruce-fir region of northern Maine. Further photographic and the multispectral studies will be undertaken in 1975 in western and eastern Maine if other funding can be obtained. The duration of the study will be three years with field work and preliminary analysis being carried out over the first two years with final evaluations and conclusions being made and released during the third year.

PROGRESS: A study has been completed on the use of color and color infrared films to successfully identify forests having current feeding, stands in need of spraying or other control measures to prevent excessive mortality, and areas with existing mortality. Current feeding was better evaluated using color photography flown at a scale of 1320 ft/in. or larger at the height of foliage browning. Stand condition and mortality were better assessed using color infrared fall photos at scales 1320 ft/in. and larger. Several industry personnel are now using these methods to control their salvage operations. Research is underway to find if remote sensing techniques can be used to assess the success of spray programs. Large scale, color infrared imagery flown this past summer and fall is being used as a data base. The photo coverage included several experimental spray test areas set-up by the University of Maine (Dr. John Dimond) and the U.S. Forest Service. (Text Abridged)

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative State Research Service, Maine

5.0019, PHENOLOGY, WEATHER AND CROP YIELDS

M.D. Ashley, University of Maine, Orono Campus, School of Forest Resources, *302 Boardman Hall, Orono, Maine* 04473 (0069645; ME08604)

OBJECTIVE: Use phenological and mesoscale weather data to understand yield dynamics and improve prediction of yield of selected agricultural crops.

APPROACH: Remote sensing imagery from satellites, aircraft and ground sources will be evaluated to provide environmental inputs for phenological and weather-crop models and project related yield studies. A network of phenological indicator plants will be used to observe the timing of seasonally related events.

PROGRESS: Some phenological-remote sensing research has been completed for this regional project and the resulting publications are cited below. The crop yield-remote sensing aspects of the project are still in the formulative stages and will be reported on when some significant progress has been made. The lilac-phenology network has been maintained. All sites, except one, have been active. All dead plants have been replaced and the spring developmental reports forwarded for further analysis.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative State Research Service, Maine

5.0020, SOURCES AND DISTRIBUTION OF TRACE ELEMENTS IN THE ANTARCTIC ATMOSPHERE

W.H. Zoller, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Chemistry, *College Park, Maryland* 20742 (DPP76-23423 A01)

This is a continuation of NSF Grant Number DPP 7623423.

In this research project, the Principal Investigator seeks to identify and classify aerosols from different sources and to determine how these aerosols interact with and are removed from the Antarctic atmosphere.

Aerosols will be collected at the Clean Air Facility at the South Pole Station during the 1978 winter-over period and during the austral summer of 1978/79. The chemical composition of these aerosols will be determined. Their variation as a function of particle size and time will be investigated and these parameters will be related to the history of the air masses being sampled. The size distribution of the particulate material will also be determined, and the effect of ice crystals scavenging for the removal of the particulate material from the atmosphere will be investigated. Airborne studies using an instrumented LC-130 aircraft will be carried out to collect samples of atmospheric particulate material above and below the inversion layer over the Antarctic continent. Sampling of the volcanic emissions from Mt. Erebus will be attempted both from the crater rim and from the instrumented LC-130 aircraft.

Logistics support is required during austral summer of 1978/79 for two persons at South Pole station and for two persons on the instrumented LC-130.

SUPPORTED BY U.S. National Science Foundation, Div. of Polar Programs

5.0021, AIRBORNE STUDY OF ATMOSPHERIC AEROSOL DISTRIBUTION

R. Markson, Airborne Research Associates, *46 Kendal Common Rd., Weston, Massachusetts* 02193 (DN790055; N00019-77-C-0372)

The objective is to obtain fundamental data on the dispersion of atmospheric aerosol particles which will relate to the pyrotechnic generation of aerosols for screening against infrared and laser radiation.

The approach will be to determine variation of visibility as a function of aerosol distribution using an airborne nephelometer. Aircraft will be piloted in and near fog, clouds, haze and smokestack plumes to record the data which will be correlated with meteorological variables.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

5.0022, DEVELOPMENT OF NONLINEAR INVERSION ALGORITHMS

A.S. Zachor, Honeywell Inc., Radiation Center, *2 Forbes Rd., Lexington, Massachusetts* 02173 (DF249800; F19628-77-C-0184)

AF function - remote sensing of atmospheric moisture environment. Deficiency - moisture information contained in DMSP satellite data is not currently utilized. Objective - to develop retrieval algorithm which will extract from the radiance data all possible information regarding atmospheric humidity structure. How research contributes - determines the capability of remote satellite sensing for mapping the atmospheric moisture environment.

Existing algorithms will be analyzed for inference efficacy. Computer code will be chosen and developed for application to block 5D DMSP H-package radiance data.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0023, APPLICATION OF TELEOPERATORS TO UNDERSEA TASKS

T.B. Sheridan, Massachusetts Inst. of Technology, School of Engineering, Dept. of Mech Engin, 77 *Massachusetts Ave., Cambridge, Massachusetts* 02139 (R/T-4)

OBJECTIVES: The objectives of this proposed multi-year program are to develop improved techniques for performing a variety of undersea manipulation and sensing tasks, tasks which are largely unpredictable, by means of teleoperation - a submersible with general purpose arms, hand and video/sonar/tactile sensors which are servocontrolled by a human operator on the surface.

This research would: provide a framework for matching present undersea tasks and available teleoperator tools, especially with respect to economic trade-offs with use of human divers; provide 'baseline' demonstrations and performance data of human controlled teleoperation in specific candidate tasks; develop new techniques for computer augmentation of teleoperators for primitive reflexive control, where the laboratory demonstrations of teleoperator sensing and manipulation of a non-cable tethered submersible which has all communication and control through a sonic link.

Because of the fatality rate (10/1000/yr in the North Sea) and the high dollar cost of human divers or manned submersibles, and because of increasing requirements for deep operations, telemanipulation promises significant safety and economic advantages. The required improvements in undersea manipulators will consist primarily in adaptation of what has recently been developed for aerospace and industrial applications.

HOW INFORMATION WILL BE APPLIED: Industrial firms and government agencies will be asked to participate in an 'undersea task -teleoperator configuration' matching analysis which comprises Task 1 of the proposal. They will be invited to observe and 'try' various simulations which are developed in successive stages (tasks 2, 3, 4). Progress reports on the project will be circulated to participating agencies for their comments, and these will be considered in guiding the research. After the first year of the project, participating agencies will be invited to a conference at M.I.T. to share concerns and views about the problem area.

ACCOMPLISHMENTS: The development of a verbal taxonomy of tasks and variables, through the survey of existing data, the conferring with many experts and practitioners, and the visiting of facilities at WHOI, Groton, CT, Philadelphia and San Diego, is essentially completed. This taxonomy is being translated in numbers and discrete tests or laboratory tasks that can be scored.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Sea Grant Office

5.0024, REFURBISH ULTRAVIOLET SPECTROMETERS

C.G. Kuczun, Tri Con Associates Inc., *Cambridge, Massachusetts* (DF580570; F19628-78-C-0043)

AF function - vehicle tracking during flight and reentry, trajectory prediction, communication systems. Deficiency - present atmospheric models predict only slight variability of the density of the upper atmosphere below 200 km; however, empirical data show this conclusion to be incorrect and observations indicate density changes as great as 50 percent in both space and time at altitudes between 120 and 200 km. This altitude region, important for Air Force operations, will be studied on a worldwide basis by density experiments aboard the DMSP satellites. The present work will support these experiments. Objective -in-situ measurements with rockets of atmospheric parameters to provide correlative data for comparison with photometric data from DMSP satellites. How research contributes - provides direct, low-altitude measurements of pertinent atmospheric properties as an aid in understanding the remote optical measurements made from DMSP satellites.

Contractor shall refurbish two rocket ultraviolet spectrometers recovered from previous rocket flights and provide field engineering services required to prepare four such spectrometers for future rocket flights. With these rocket payloads measurements will subsequently be made of the photoelectron flux and differential energy distribution for energies between 0 and 100 electron volts, of the radiance of nitrogen airglow at 3371 angstroms and of the density and composition of the upper atmosphere as established by solar ultraviolet photon absorption rates. All measurements will be made from a single rocket payload in the altitude range between 120 and 200 km.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0025, DEVELOP ION MASS SPECTROMETER TO MEASURE D-REGION LUSTER IONS FOR LF/VLF COMMUNICATIONS

A.D. Bailey, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF581100)

AF function - communications, detection, track and intercept, nuclear weapons delivery. Deficiency - inability to forecast atmospheric interactions affecting the design and operation of military LF/VLF and other systems such as over-the-horizon radar, polar communications, reentry vehicles and satellite ephemerides. Objective - develop and test instrumentation to accurately measure positive and negative ion composition and densities in the d and e regions, especially between 40 and 90 km for calculations of LF/VLF transmissions. How research contributes - provides instruments for, and conducts experiments measuring the composition and densities of ion species important to AF systems operations. The mass distribution of large positive and negative ion clusters between 40 and 90 km is not well known. This effort will attempt to determine the ion composition and physical-chemical processes which degrade LF/VLF communications and otherwise affect AF EM systems operations.

A new instrument will be designed to overcome difficulties previously encountered in attempts to measure heavy ions in the 40 to 90 km region. Rocket-borne measurements with this instrumentation are planned for latter FY78 to measure mid-latitude diurnal variations. Measurements in FY79 are planned for twilight measurements of photo-detachment and electron attachment processes. Such basic measurements should establish the capability to assess cluster concentrations in future programs during polar disturbances.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0026, ATMOSPHERIC DENSITY MEASUREMENTS WITH A LASER RADAR SYSTEM

D.E. Bedo, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF581220)

AF function - vehicle tracking, trajectory prediction, interception. Deficiency - insufficient information on a timely basis of the atmospheric density and variations in density at altitudes ranging from 8 to 20 kilometers as is required for advanced reentry systems. Objective - the development of a satellite-borne laser radar system capable of providing near real-time, remote density measurements at stratospheric altitudes and below. How research contributes - the laser radar system will provide near real-time measurements of the total density of the probed regions of the atmosphere as determined from the Rayleigh scattered laser light. Such data are of value to the Air Weather Service in support of strategic missile systems.

The laser radar system to be developed will be based on the detection of Rayleigh scattered laser light with appropriate timing and gating electronics. The transmitter consists of a pulsed laser whose power (of the order of a few joules) and pulse repetition rate will depend upon spacecraft capabilities. A laser pulse width of the order of a microsecond will allow one kilometer resolution in the density data. The reciever consists of a large-aperture Cassegrainian telescope followed by turning and beam defining optics and photomultiplier detectors. Timing circuitry will prevent observation of the near-field scattering and restrict the measured signal to that from the remotely probed altitudes.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0027, EVALUATION OF REMOTE CHEMICAL SENSING TECHNIQUE

J.P. Kennealy, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF580270)

AF function - stationary target surveillance, reconnaisance, and designation. Deficiency or opportunity - requirement to detect and discriminate weak infrared signatures of stationary source effluents which are characteristic of specific activities. Objective - to evaluate, develop, and demonstrate detection sensor concepts capable of successful utilization for stationary source surveillance. How research contributes - defines and configures optimum detection schemes for remote chemical sensing.

Existing and near term prospective capabilities for high-sensitivity, high-resolution detection discrimination and assay of chemicals in the atmosphere, remotely, by optical means, will be identified, analyzed and evaluated. Existing data and analytical models will be used in further evaluation of the operational feasibility of selected concepts, and a field test will be conducted of breadboard versions to be built of sensors designed to exploit desirable performance features identified in the study.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0028, JOINT AGENCY DOPPLER TECHNOLOGY TESTS

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AF function - observing and forecasting the environment in direct support of strategic and tactical operations. Deficiency - operational effectiveness of present weather radar instrumentation is not sufficient to meet operational support requirements. Objective - to perform an evaluation, jointly with AWS, NWS, and NSSL, of present Doppler weather radar instrumentation and techniques in an operational environment. How development contributes - provides a more reliable means for the identification and forecasting of hazardous weather.

A Doppler processor, color display unit and associated interpretive techniques will be tested to determine the feasibility of transferring these research instrumentation and techniques to operational utilization. The joint agency Doppler technology tests have been and will be conducted in the months of April to June of 1977 and 1978 at the National Severe Storms Laboratory, Norman, Oklahoma. Lessons learned in the 1977 tests will be incorporated in the operations plan for the 1978 tests. Upon completion of the tests, the operational suitability of procedures, techniques, and instrumentation will be determined. The work under this IHWU was formerly carried out under IHWU 66720301.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0029, POST BURNOUT THRUST AND OUTGASSING MEASUREMENTS FOR SOUNDING ROCKETS

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AF function - sounding rocket operations. Deficiency - degradation of scientific data due to interference from expended solid propellant sounding rocket motor. Objective - to determine the magnitude of low level post burnout thrust, outgassing and particulate contamination by spent solid propellant rocket motors. How research contributes - knowing the magnitude of the hot gas discharge, motor throttling devices or vehicle/payload separation systems could be developed that would allow clean payloads to fly on the normally less expensive solid propellant rocket motors.

A separable payload will be designed and flown on a solid propellant sounding rocket motor that will measure the post burnout combustion mass flow rate and resulting thrust, monitor the diffusion of motor outgassing, and observe and measure the relative motions of the two bodies.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0030, SUNSPOT-FLARE ASSOCIATION

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AF function - communications, surveillance, detection, tracking. Deficiency - inadequate warnings of sun-induced disruptions. Objective - the determination of rapid day-to-day changes in the physical appearance of sunspot groups which are associated with the development of flare activity. In particular, this will be a study of rapid changes in the two-dimensional structure of motions of the spots which comprise the groups. The successful association of flare activity with these changes in appearance would lead directly to improvements in the forecastability of flares and their associated effects on the terrestrial environment. How research contributes - provides the physical knowledge necessary for a sound cause-and-effect prediction technique for solar-induced disruptions.

The analysis will initially focus on the collection of all the measures of the characteristics of individual sunspot groups compiled from a number of different observatories and the associations of these parameters with their appropriate group. No single observatory records all the required parameters. In addition, a normalized flare record will be acquired and tied (flare-by-flare) to the associated spot group. The occurrences of dramatic two-dimensional changes will be extracted from the sunspot record and these changes will be classified into a number of separate categories. The characteristic flariness associated with each of these separate categories of sunspot behavior will be calculated. This flare behavior will then be compared with the expected level of flariness associated with the more or less 'static' stage of development of the spot group to determine whether these rapid changes in spot behavior add useful predictive information.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0031, EXPERIMENTAL TROUGH AND TROUGH WALL STUDY

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AF function - communication, radar. Deficiency - the f-layer trough and poleward trough wall introduce range and azimuth errors to radar systems. Objective - to map the development and structure of the mid-latitude f-layer trough, the structure and dynamics of the trough wall and its relation to the discrete/diffuse aurora. How research contributes - to assist the empirical and theoretical understanding of the f-layer trough to provide reliable operation of radar systems such as CONUS OTH-B which operate in this environment.

During the winter 1977/78 two expeditions (3 flights each) in the Goose Bay sector will provide ionospheric sounder, all-sky photometer and other relevant airborne geophysical measurements. Ground-based backscatter and vertical ionospheric soundings, as well as ionospheric horizontal drift measurements will be conducted simultaneously from Goose Bay. These measurements will be analyzed to investigate the post sunset development of the trough, the dynamics and north/south gradient of the poleward trough wall, and the spatial relation of the trough wall to the region of continuous/discrete auroras. A unique aspect of this experiment is the technique of inferring ionospheric characteristics from optical as well as radio wave measurements. The complementary nature of these observational methods allows unambiguous interpretation of ionospheric characteristics which have previously been considered independently.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0032, DESIGN OF AEROSPACE EXPERIMENTAL INSTRUMENTS

J. Otis, Wentworth Inst., Undergraduate School, *550 Huntington Ave., Boston, Massachusetts* 02115 (DF580010; F19628-78-C-0017)

AF function - military operations of the B-1, F-15 and other AF vehicles in the stratosphere, nuclear weapons delivery, communications, detection, track, and intercept. Deficiency - environmental effects of AF stratospheric operations cannot be predicted because of a lack of stratospheric data. Further, mixing

and chemical effects of jet engine or missile effluents are only poorly defined. Also, inability to forecast upper atmosphere interactions affecting the design and operation of military systems such as reentry vehicles, over-the-horizon radar, polar communications and satellite ephemerides. Research -design, test and provide quadrupole mass spectrometers and gas sampling hardware with associated support equipment to be used in rocket and balloon-borne experiments. Cryogenic, vacuum, and contaminate-free technologies are used. How research contributes - establish stratospheric standards and criteria by period in situ and laboratory gas analysis and provide data for upper atmospheric assessment models by measurement of neutral and ionized species.

Consultation between experimenters and mechanical designers to include review of mechanical designs and monitoring the fabrication, delivery of prototype instruments, testing in flight configurations, design, updates, if necessary. Designers may be required to operate instruments during field experiments.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0033, FURTHER ERIM ANALYSIS OF SAR OCEAN DATA

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OBJECTIVE: The objective of this research is to: (1) Provide further guidance in the processing of SAR data of ocean waves, and (2) Determine the limitations of SAR for collecting useful oceanic data.

APPROACH: Existing SAR data collected during the SEASAT-A Marineland experiment in 1975 and during the 1976 hurricane season are to be analyzed in terms of the modulation depth measurements as a function of wave direction, wind direction, wave orbital and group velocities, surface current velocity, number of coherent looks and spatial resolution. Wave spectra as a function of radar range will be processed from different segments of the Gulf Stream (Marineland data set).

PROGRESS: The previous quantitative analyses by ERIM have pointed out a major limitation in imaging waves by a SAR system due to wave velocity components interacting with the Doppler signal. ERIM first showed that improvement in the quality of the image could be obtained by altering focus from that used for conventional terrestrial imaging.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0034, EVALUATION OF URBAN TREE VIGOR FROM COLOR AND COLOR-IR AERIAL PHOTOGRAPHY

C.E. Olson, University of Michigan, Ann Arbor Campus, School of Natural Resources, *Ann Arbor, Michigan* 48104 (0070637; MICY00092-F)

OBJECTIVE: Determine whether declining vigor in urban trees can be detected from medium-scale, color and color-IR air photos, and assess consistency with which declining tree vigor can be determined from color and color-IR air photos by different photo-interpreters.

APPROACH: Prior work under Project MICY-F037 provides substantial information on symptoms of maple decline, and a population of identified urban maple trees whose symptoms have been determined from ground observations. Color and color-IR air photos at a scale of 1:8,000, obtained on July 4, 1975, are available for the study area. Four sample areas have been identified. Twelve image interpreters will examine the photography stereoscopically and record any symptoms of tree stress observed within each test site. Results will be compared with 1975 ground assessments of these same trees to determine accuracy and consistency of photo assessments of maple decline. Work can be expanded to other species and causes of vigor decline.

PROGRESS: Color and false-color air photos at RF equals 1:8000 were examined by two randomized groups of interpreters to determine the accuracy and consistency with which symptoms of maple decline could be detected in three study areas. Preliminary results indicate that greater accuracy and consistency were achieved with the false-color film. Data analysis is continuing.

SUPPORTED BY Michigan State Government

5.0035, FOREST RESOURCE MANAGEMENT APPLICATIONS OF MEDIUM- TO HIGH-ALTITUDE COLOR INFRARED AERIAL PHOTOGRAPHY

M.P. Meyer, University of Minnesota, St. Paul Campus, School of Forestry, Mcintire Stennis Program, *301 Green Hall, St. Paul, Minnesota* 55108 (0064373; MIN-42-050)

OBJECTIVE: Improve the efficiency of forest land managers through the determination of the best type and the cost-effectiveness of medium-and high-altitude infrared color aerial photography for forest resource surveys and forest land management.

APPROACH: A forested area in Northern Minnesota will be photographed using standard forestry aerial photography and various types of smaller scale color infrared aerial photography. Selected forest survey and forest management information needs which can be determined from aerial photographs will be interpreted by locally experienced trained professional forest aerial photo interpreters. The results of the interpretations will be analyzed by statistical means as well as interpreter reaction. At the same time, data on the costs of the two types of aerial photography will be determined. A benefit-cost approach will be used to determine the optimum type of photography for forest survey and management purposes. In addition to the project interpreters, all possible local, on-the-ground, land managers will be given copies of the photography to evaluate in their own terms.

PROGRESS: Numerous public agency and industrial forestry user-cooperators completed evaluation of various film/filter/scale combinations (B&W and color infrared/1:15,840, 1:24,000, 1:31,680 and 1:80,000 scale) of summer forest aerial photography in various Minnesota locations; data analyzed, manuscript accepted for publication. Over 200 miles of power transmission line right-of-ways in forested areas flown with various 35mm film/filter/scale combinations to develop a cost-effective means of surveillance and management; data undergoing final analysis. A test of fourteen metric camera filter/film exposure-development/printing combinations reliably identified the reasons for the serious tonal contrast deterioration noted in 1:15.840 scale B&W IR summer forest photography in recent years; corrective contract specifications developed, manuscript completed and submitted for consideration.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative State Research Service, Minnesota

5.0036, A STUDY OF THE SOUTHWEST (S.W.) MONSOON

G.V. Rao, St. Louis University, School of Arts & Sciences, Dept. of Earth & Atmospheric Sciences, *221 N. Grand Blvd., St. Louis, Missouri* 63103 (ATM77-20631)

The primary objective of this research is to analyze data collected by the principal investigator and several other scientists during Monsoon 77, an NSF supported field experiment that took place in the East African-Western Indian Ocean region. Monsoon 77 is a precursor to the Monsoon Experiment (MONEX), a GARP regional subprogram which will take place in FY 1979. The data were collected from an aircraft platform during flights across and along the Somali jet, a low-level, stream of air that flows north-northeastward off the coast of East Africa and provides moisture for summer monsoon rains. The research goal is to calculate moisture fluxes provided by the jet flow and compare these against evaporation and condensation data over the Arabian Sea. The structure of the jet will also be studied.

Secondary goals are: (1) To use the National Center for Atmospheric Research (NCAR) general circulation model to conduct sensitivity experiments for determining how prolonged equatorial sea surface temperature anomalies influence the monsoon circulation, and (2) to clarify the role of the Southern Equatorial Trough (SET) in the Indian monsoon circulation.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0037, CHARACTERIZATION OF VEGETATION AND DRAINAGE IN STRIP MINED LANDS UTILIZING REMOTE SENSING TECHNIQUES

C.J. Johannsen, University of Missouri, Columbia Campus, Agricultural Experiment Station, Dept. of Agronomy, *130 Jesse Hall, Columbia, Missouri* 65201 (0071419; MO-684-15-20)

OBJECTIVE: Characterize vegetation and drainage patterns of representative stripped mined areas to evaluate reclamation methods. Extend information to larger areas by remote sensing techniques. Provide information in format usable by reclamation authorities.

APPROACH: Study sites will be selected from three different surface mining stages: Pre-1950, 1950-1972 (surface mining law passed) and 1972 to present. Study sites will be flown at different seasons of the year to evaluate surface cover. Current photography using four film types plus previous photography will document revegetation success. Random 1000 square meter quadrants will be ground truthed identifying specie composition and density. Photographs will be digitized and analyzed by computer utilizing pattern recognition techniques. Assessment will be made of vegetation density. LANDSAT images will also be analyzed over selected areas. Drainage patterns and their influence on reclamation methods will be evaluated. Results will be provided to Extension Service personnel to be utilized in educational programs as well as work by State Reclamation Commission.

PROGRESS: The co-investigators have been meeting regularly and determining the best locations for study sites. Mining maps obtained from the Land Reclamation Commission, topographical maps and aerial photography have been used in this effort. Contacts have been made with two mining companies in the state and our program has been explained to them. The Research Specialist and students have been seeking the best procedures for obtaining ground truth and for analysis of the data.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative State Research Service, Missouri

5.0038, CHARACTERIZATION OF PROPERTIES OF STRIP MINE SPOILS AS RELATED TO REMOTE SENSING MEASUREMENTS

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OBJECTIVE: Characterize the available plant nutrient status of pre-mined overburden layers and the resultant mined spoils determining their necessities for selected plant species. Determine rate and control of pyrite oxidation in overburden layers. Characterize vegetative responses and hydrologic conditions by remote sensing techniques.

APPROACH: Study sites will be selected from three active surface coal mines in Central Missouri. Soil samples will be obtained from the different geologic layers in the high wall cuts. The rate of pyrite oxidation to sulfuric acid at various pH, EL and O(2), also nutrient levels will be determined. The necessity for lime and plant nutrients in reclaiming mined spoil areas will be determined by soil tests and field plot techniques. Vegetative cover and densities will be determined for all plots and check areas. Correlations will be made of vegetative responses with responses measured on color infrared film. Hydrology aspects of vegetative and topographic patterns will be determined from aerial photography. Results will be provided to Extension Service personnel to be utilized in educational programs and to the Missouri Land Reclamation Commission for use in their programs.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative State Research Service, Missouri

5.0039, REMOTE SENSING APPLICATIONS FOR THE ANALYSIS AND MANAGEMENT OF RENEWABLE NATURAL RESOURCES

P.T. Tueller, University of Nevada, Reno Campus, Agricultural Experiment Station, Dept. of Renewable Natural Resources, *Reno, Nevada* 89507 (0067967; NEV00614)

OBJECTIVE: Investigate remote sensing techniques for application to natural resources management including range, forestry, wildlife, watershed, outdoor recreation and crop agriculture. Test techniques for vegetation mapping, wetland inventory, range condition and trend, erosion evaluation, and economic value. Assess site biomass and production, land use mapping and classification. Conduct resource inventories and serve as a repository for remote sensing data.

APPROACH: Various scales (1:600 to 1:1,000,000) of color and color infrared film types along with actual ground data, densitometers, and field-averaging spectrographs will be used to identify phenomena relative to subjects being investigated. Accepted and experimental techniques and procedures will be used and evaluated. Computerized imagery from Land Set 1 and 11 will be evaluated. In all cases application will be emphasized.

PROGRESS: During the summer of 1976, twelve study plots located in seven vegetation types were selected and ground data collected. The vegetation types sampled were Black sagebrush/Bluebunch wheatgrass, Big sagebrush/Bluebunch wheatgrass, Big sagebrush/Idaho fescue, Big sagebrush/Sandbergs Bluegrass, Low sagebrush/Sandbergs Bluegrass, Low sagebrush/Bluebunch wheatgrass, and Low sagebrush/Idaho fescue. Large-scale (1:600) color and color infrared aerial photographs were taken of all plots. Technical difficulties with lenses and cameras hampered the attainment of high-quality imagery on all sites. A second mission was flown with improved quality of imagery, but not at the level desired. Preliminary multiple regression analysis of ground data has not established significant correlations between plant community parameters measurable on the aerial photographs and forage production. However, estimates of percent shrub cover from aerial photos are not statistically different from ground data estimates at the 95% confidence level. Various approaches to the problem such as nonlinear regression and data transformation are under investigation.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative State Research Service, Nevada

5.0040, NAVY ENVIRONMENT - CLOUD CHARGING

W.P. Winn, New Mexico Inst. of Mining & Technology, Graduate School, Dept. of Physics, *Campus Station, Socorro, New Mexico* 87801 (DN223113; N00014-75-C-0168)

In connection with naval operations involving missiles and aircraft in deteriorating weather a part of the objective of this research is to define the environment limits for such operations in terms of electrical hazards for the distinctly different electrical regimes that exist in the subcloud layer at sea as compared to the subcloud over land.

By means of a instrumentation hung in a pair of spheres rotating around a vertical shaft and moving either in free fall or on a tethered balloon, the horizontal and vertical electrical fields are measured both in and below an electrified cloud. At the same time fields are measured at the ground by separate instrumentation. What is obtained is a history of the voltage against time at the ground, at 200 meters, and in the cloud.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0041, INVESTIGATION OF TWO AREAS IN NEW YORK STATE WHICH MAY HAVE POTENTIAL FOR GEOTHERMAL ENERGY

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Two potential areas for dry hot rock geothermal energy in New York State will be studied. The Adirondack Mountains dome, which has been undergoing vertical uplift along its eastern flank, will be releveled across its axis by the National Geodetic Survey as part of this research project. The investigators will evaluate the results in terms of possible contemporary doming of the Adirondacks as a whole. At the center of the dome is Blue Mountain Lake, site of recurrent swarm-type earthquakes. The investigators will study the surface trace of the fault plane involved in detail by geological, magnetic and gravity mapping. An anomalous circular drainage feature in the Catskill Mountains, which shows prominently on LANDSAT imagery, will be investigated in terms of bedding altitude, photolinears which approach but do not pass through the structure, gravity, magnetics, scintillometry, and seismic monitoring. If the structure is one of increased

volume, such as a gentle dome, and is characterized by attenuated P and S waves, thermal expansion and a thermal source at depth will be suspected. A first order leveling across the Adirondack Mountains Dome has been resurveyed and preliminary results indicate a doming at a rate of 3.76 mm/year. The stratigraphy of adjacent areas is being examined in an attempt to date the doming. Chemical samples have been obtained from Blue Mountain Lake in the vicinity of recurrent, swarm-type earthquakes and are being analyzed in order to determine if gases or thermal brines are being released under water. East-West and North-South gravity profiles across the study area in the Catskill Mountains indicate a major gravity low. (ERDA-76/53/1)

SUPPORTED BY U.S. Dept. of Energy, Div. of Geothermal Energy

5.0042, OBSERVATIONS OF TOPOGRAPHIC ROSSBY WAVES AND GULF STREAM MEANDERS ALONG THE CONTINENTAL SLOPE

D.A. Brooks, University of North Carolina, North Carolina State University, School of Mathematics & Physical Sciences, Dept. of Geosciences, *Raleigh, North Carolina* 27607 (OCE77-25682)

This project, which involves field observations and data analysis, is designed to study topographic and meteorological forcing of observed meanders of the Gulf Stream along the continental slope south of Cape Hatteras, North Carolina. A field study consisting of four-month long winter and summer mooring periods will examine the detailed structure and time history of the current and temperature fluctuations along the continental slope off North Carolina. Vertical and cross-slope structure and alongshore propagational characteristics will be determined. Correlation of the current and temperature data with wind data, and comparison of direct current data with satellite imagery of sea-surface temperature patterns will be done to investigate the possiblities of wind or lee-wave forcing. Field data will be compared with theory to assess the importance of stable topographic Rossby wave propagation and instability processes in the Stream. This is a three year project with the field work occurring during the first and second years.

SUPPORTED BY U.S. National Science Foundation, Div. of Ocean Sciences

5.0043, THERMAL INFRARED PATTERN RECOGNITION

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Remote sensing data acquired by satellite in the infrared portion of the spectrum has been analyzed to determine the correlatability of thermal patterns of the earth's surface. Diurnal and seasonal effects, as well as unusual weather conditions, were found to adversely influence observed pattern correlations.

SUPPORTED BY Oklahoma State Government

5.0044, OCEAN CLIMATOLOGY AND MONITORING

M. Ingham, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Marine Fisheries Service, Northeast Fisheries Center, Atlantic Environmental Group, *Narragansett, Rhode Island* 02882 (NEC-084)

This task conducts studies of marine environmental conditions in the western North Atlantic and Gulf of Mexico, principally in coastal areas, utilizing climatological data bases and recent monitoring data, some of which are collected by task members. The understanding of environmental variation gained through these efforts is applied to studies of the effects of this variation on the distribution and abundance of living marine resources. Current year objectives include completion of a temperature climatology for the Middle Atlantic Bight, continued expansion of the Ship of Opportunity Program for monitoring subsurface conditions, continued surveillance of satellite data for determining the trajectories of warm core eddies passing through the slope water mass along the outer continental shelf, continued accumulation and analysis of climatological data for Georges Bank and the Middle Atlantic Bight, and continued efforts to coordinate the various monitoring efforts in the waters of the Atlantic Shelf and Slope.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Marine Fisheries Service

5.0045, NAVY ENVIRONMENT - ATMOSPHERIC WATER VAPOR

T. Ashworth, South Dakota School of Mines & Technology, Graduate School, Dept. of Physics, *Rapid City, South Dakota* 57701 (DN323084; N00014-75-C-0214)

To fill the need for an expendable in situ humidity sensor for very low atmospheric humidity to be used in conjunction with the development of remote sensing techniques for water vapor in the atmosphere, the aim of this research is to attack the complex of problems involved in the testing, calibration, modification, and development of such sensors. The research will benefit Navy efforts to cope with the refractive index problem that hampers modern weaponry.

A low-humidity chamber will be used to examine and calibrate existing sensors, particularly those prepared on NR 082-176. The chamber is reliably calibrated to dew points of -10 C. It can go to dew points of -80 C with less reliable calibration. Better calibration of the chamber is part of better calibration of the sensor improvement under this task. The properties of amorphous silicon oxide will be investigated to determine suitability as low-temperature humidity sensor.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0046, REMOTE SENSING FOR LAND RESOURCE MANAGEMENT WITH RANGELAND EMPHASIS

R.H. Haas, Texas A & M University, College Station Campus, Agricultural Experiment Station, Dept. of Range Science, *College Station, Texas* 77843 (0062471; TEX01978)

OBJECTIVE: Investigate the use of remote sensing for inventorying rangelands and other natural ecosystems for local and regional resource management. Evaluate the use of aircraft and spacecraft sensor data for monitoring the effects of weather and management on short-term range feed conditions and long-term successional changes in vegetation. Acquire basic information on reflectance characteristics of natural vegetation systems for cataloging phenological effects. Evaluate the cost-effectiveness of potential remote sensing applications.

APPROACH: Sequential, multispectral imagery will be obtained from rangelands with known management treatments. Existing and new aerial photography will be evaluated for observable differences in reflectance characteristics and compared with 'ground truth' data collected at selected sites. Terrestrial and aerial photography, as well as vegetation data and existing soils information will be used to evaluate satellite imagery for monitoring seasonal changes in vegetation conditions. Various types of remote sensing data will be evaluated as new information sources for practical application to the management of rangelands and other natural ecosystems.

PROGRESS: Efforts were continued to develop the application of satellite data and aerial photography for land resource management. NASA-sponsored studies show that the Transformed Vegetation Index (TVI-6) is useful in estimating the amount of green biomass per unit area in increments as small as 200 kg/ha at critical seasons of the year. Herbage production, production change and woody plant density are parameters readily mapped using TVI-6 values in predictive equations. Several factors have been isolated which affect quantitative estimation of herbage production from TVI-6, including the overshadowing annual broomweed. Color infrared aerial photography has been used on the Waggoner Grant study to document successional changes following brush control. Patterns of succession were related to kind of treatment. Significant changes were related to transition zone and the zonal area about mesquite plants. Mesquite canopy reductions was measured for 2 and 3 year-old treatments using available aerial photography. Broomweed density was estimated successfully using a stratified sampling approach. (Text Abridged)

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative State Research Service, Texas

5.0047, REMOTE SENSING - INSECTS

W.G. Hart, U.S. Dept. of Agriculture, Agricultural Research Service, Citrus Insects Research, *509 W. 4th St., Weslaco, Texas* 78596 (0044017; 7202-20222-001)

OBJECTIVE: Develop new procedures for detection of Mediterranean fruit fly, citrus black-fly, meadow spittlebug and other sub-tropical insects population densities and dispersal patterns and determine the density and distribution of host plants, such as coffee, almonds, mangos and citrus, of these insect pests.

APPROACH: Color infrared aerial photographs will be taken of the Mediterranean fruit fly, citrus blackfly, meadow spittlebug and other sub-tropical insect infestations. Ground data will be collected and correlated with the photographic data to determine signatures of these insect infestations. Detection of insect populations from photographs will be based on changes in plant conditions that give spectral signatures for specific insects, or changes the geometric shape of plants or by detection of structures built by the insects. Spectral differences and/or planting patterns will be used to determine host plants.

SUPPORTED BY U.S. Dept. of Agriculture, Agricultural Research Service, Subtropical Texas Area

5.0048, PATTERNS AND RATES OF PINYON UNIPER WOODLAND INVASION AND SUPPRESSION OF UNDERSTORY VEGETATION

N.E. West, Utah Higher Education System, Utah State University, Agricultural Experiment Station, Mcintire Stennis Program, *Main Bldg., Room 104, Logan, Utah* 84321 (0064999; UTA00750)

OBJECTIVE: Understand patterns of succession in Great Basin-pinyon-juniper woodlands.

APPROACH: Plots will be established in transects regularly arranged within the woodland belt on two Great Basin mountain ranges. Data on total vegetation, soils, slope, aspect and land use will be collected. Samples of trees and shrub stem sections will be taken to obtain age and growth rate data. These data will be related statistically and to aerial photographic coverage so mappable units can be devised and related the management problems and potentials.

PROGRESS: Refinements of a general mathematical model of successional change in forests and woodlands were made. Model verification has been done on as many suitable independent data sets from the literature as possible. This model consistently describes, with more ease than previous versions, the development of single species stands. The results of the model clearly indicate what important plant parameters can be measured on a community basis for more reliable description of multi-species communities undergoing succession. The bulk of the year was spent reducing biomass and growth rate data from the plants of an intensely sampled successional gradient in pinyon-juniper woodlands on the Needle Range of southwestern Utah. This data is now being used to test the most efficient and effective ways of field sampling for the plant parameters indicated as important by the model, to test how effectively and with what estimated error the more commonly used sampling methods approximate the important parameters, and make a first description of successional patterns in pinyon-juniper woodlands based on the parameters determined as important by a single species model. When completed these results will serve as a base line from which methods of adjustment will be developed to predict rates of woodland succession under other stand and site conditions.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative State Research Service, Utah

5.0049, PROTOTYPE EXPERIMENTAL GROIN, POINT MUGU, CALIFORNIA

J.R. Weggel, U.S. Dept. of Defense, Army, Corps of Engineers, Coastal Engineering Research Center, *Kingman Bldg., Fort Belvoir, Virginia* 22060 (31237)

OBJECTIVES: To determine by prototype field experiments: (1) the manner in which a groin traps littoral materials; (2) the effect of the groin's shape and dimensions on the volume of entrapped littoral materials; and (3) the manner in which littoral materials move over, or through, a groin.

APPROACH: The field investigation of prototype groins resulted in the obtaining of topographic and bathymetric surveys, ground and aerial photography, determination of longshore energy flux and the characteristics of sediments to document the functional behavior of selected groin configurations and their effect on adjoining shores. Two impermeable groins and three permeable groins were constructed and data collected on each. The first, a long high impermeable groin was in place from November 1970 to November 1971; the second, a short, low impermeable groin was in place from April 1972 to June 1973. Permeable groins were constructed in three phases providing increasing structure width and obstruction to the movement of littoral materials. Phase 1 was in place from June 1974 to April 1975; Phase 2 from April 1975 to October 1975; and Phase 3 from November 1975 to June 1976. The data collection phase of the Prototype Experimental Groin project was terminated 30 June 1976.

SUMMARY: This study will result in better design criteria and an understanding of the functional behavior of groins and their effects on adjoining shores. The work unit to data has resulted in two reports; CERC MP 1-72 'Groins: An Annotated Bibliography' and CERC Reprint 15-73: 'State of Groin Design and Effectiveness'. Additional reports will be published in the CERC report series during FY 78 and FY 79. Corps Divisions and Districts will use these techniques to achieve a more rational use of groins in shore protection projects and to simplify their functional design.

SUPPORTED BY U.S. Dept. of Defense, Office Chief of Engineers, Corps of Engineers

5.0050, RESEARCH IN ANTARCTIC METEOROLOGY

W. Schwerdtfeger, University of Wisconsin, Madison Campus, School of Letters & Science, Dept. of Meteorology, *500 Lincoln Dr., Madison, Wisconsin* 53706 (DPP77-04506 A01)

This project is a continuation of NSF Grant Number DPP 7704506. It involves research into four aspects of the synoptic meteorology of Antarctica, using historical data, present-day U.S. and foreign synoptic observation, and satellite measurements. The research will focus initially on the tropospheric moisture transport into East Antarctica and on the atmospheric driving forces of the Weddell Sea gyre, then continuing into an investigation of strong terrain-induced surface winds and cold-air jets in the atmospheric boundary layer. No logistics support required since no field work will be done.

SUPPORTED BY U.S. National Science Foundation, Div. of Polar Programs

5.0051, PRECIPITATION MEASUREMENT BY MICROWAVE RADIOMETRY

J.A. Weinman, University of Wisconsin, Madison Campus, School of Letters & Science, Dept. of Meteorology, *500 Lincoln Dr., Madison, Wisconsin* 53706 (ATM75-21117 A01)

The goal of this research is to define the characteristics of a microwave radiometer system that may be used to measure remotely precipitation over sea and land from a satellite. Microwave radiation emitted by precipitation is a function of the density, phase and size distribution of the hydrometeors as well as the horizontal extent and vertical distribution of the hydrometeors. Because these factors are intermeshed, the research effort will attempt to determine the sensitivity of microwave brightness temperature for each of these parameters. The research will consist of a theoretical effort and an experimental effort. The theoretical part will consist of a set of systematic calculations to evaluate the absorption and scattering for spherical hydrometeors, the effect of multiple scattering in inhomogeneous clouds and the effects of the finite horizontal extent of columnar clouds. The experimental part will consist of a series of microwave brightness measurements obtained from aircraft-borne radiometers. These measurements will be obtained at several wavelengths and polarizations and will be used to check the validity of the theoretical work.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0052, DEVELOP LOW-COST SYSTEM FOR RAPID IMAGE ANALYSIS AND TO APPLY THE VIDEO ENHANCEMENT CAPABILITY TO URANIUM EXPLORATION

R.W. Marrs, University of Wyoming, School of Arts & Sciences, Dept. of Geology, *P.O. Box 3435, University Station, Laramie, Wyoming* 82070

Results from evaluations of ERTS-1 (Earth Resources Technology Satellite) multispectral scanner data indicate a definite potential for direct identification of hydrothermally altered and mineralized areas through interpretation of enhanced imagery. The proposed research program involves construction of a low-cost video image analysis system which can provide image enhancement of a type and quality comarable to present digital systems. The completed video image analysis system will be employed in a study of several areas of known uranium mineralization to define the capability of the system and the applicability of image enhancement techniques to uranium exploration. Successful procedures will then be applied to selected test areas for delineation of unknown areas of uranium mineralization. The complete system, as constructed by Spatial Data Systems, would have the following capabilities: density analysis, area management, edge enhancement, base level adjustment, gain change, band addition, band inversion, band subtraction, band multiplication, band ratioing, addition and subtraction of band combinations. Selective use of these various capabilities in sequence allows enhancement of almost any image feature and delineation of any features that are ordinarily unrecognizable. The system does not require digital input, so it is equally effective with photography or imagery. The major uranium districts of Wyoming will be used as reference test areas. The overall test region will include the Black Hills and Powder River Basin, the Wind River Basin, Shirley Basin and Northern Green River Basin.

SUPPORTED BY U.S. Dept. of Energy

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, FACTORIAL COMPOSITION OF THE ASPT AUTOMATED MEASUREMENT SYSTEM

P.A. Irish, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Williams Air Force Base, Chandler, Arizona* 85224 (DF223720)

The objective is to obtain a valid technique for defining the relevant dimensions of pilot performance measurement and eliminate redundant or non-informative measures. Economy in the requirements of automated measurement is a prerequisite for meaningful implementation in an operational environment. Cost reductions are possible in the acquisition of the necessary computer equipment if realistic estimates of measurement requirements are available. Several empirical (as opposed to analytical) approaches to achieving descriptive economy in the automated performance measurement system of the ASPT will be investigated.

Four groups of 16 pilots, representing four experience levels, will fly three repetitions each of two maneuvers, the constant rate climb and constant rate descent. Automated performance measures will be collected on all maneuvers. The measures will be subjected to one of three pre-selection techniques, and will be input into a multivariate multiple discriminant analysis. The results of these analyses will begin to define the factorial structure of the current measurement system and begin to provide information on which measures may be eliminated without a real loss of important information. Subsequent data collection will be undertaken to provide cross-validation of the finds of the initial data analysis.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0002, ASPT AIR-TO-AIR COMBAT SIMULATION SOFTWARE DEVELOPMENT

E.G. Monroe, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Williams Air Force Base, Chandler, Arizona* 85224 (DF223870)

To increase the training capability of the advanced simulator for pilot training in the area of air-to-air combat. To accomplish this, the visual system will be improved to simulate the visual effect of cannon and rocket fire and the effects of sun-glint and glare.

The existing ASPT software will be modified to generate a simplified additional moving model. The present system of software will be utilized to simulate cannon and rocket fire from the viewpoint aircraft. Program scoring algorithms for scoring pilot performance will be developed for display on a vector general. Finally hardware and software modifications to the ASPT system will be developed to simulate the visual effect of sun glint off a lead aircraft and glare on the viewpoint windshield.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0003, CONCURRENT MULTITASK PERFORMANCE MEASUREMENT

J.M. Owens, U.S. Dept. of Defense, Navy, Naval Aerospace Medical Research Lab., Aerospace Psychology Dept., *Pensacola, Florida* 32512 (DN677133)

Naval aviators and flight officers operate complex systems which require them to respond to many simultaneous competing task demands. Improvement of total systems efficiency and effectiveness is dependent upon the development of useful and reliable techniques for specifying and measuring the quality of human performance in complex systems. This project is directed toward the systematic development of a methodology for measuring concurrent multitask performance in aviation-relevant task situations.

A dedicated high-speed computer will be used for the presentation of tasks with both continuous and discrete display and control characteristics. The tasks employed will be representative of the sensory, cognitive, and control processing requirements of actual aircrew tasks. Situational alterations of the structure and workload demand characteristics of the tasks will allow the address of a broad range of complex performance problems associated with increased operator efficiency in aviation man-machine systems. The approach to more effectively specify and quantify the quality of operator performance in high-demand multitask situations emphasizes the use of adaptive task loading techniques. These performance measurement techniques employ dynamic alterations of multiple task demands commensurate with individual skill levels in order to achieve more precise estimates of operators' capabilities under any given set of task requirements.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Aerospace Medical Research Lab.

6.0004, THE EFFECTS OF SMOKING ON TIME ESTIMATION PERFORMANCE

N.W. Heimstra, University of South Dakota, Vermillion Campus, School of Arts & Sciences, Dept. of Psychology, *Vermillion, South Dakota* 57069 (DA0A7886; DADA17-73-C-3037)

The objective is to determine the relationships between smoking and (1) the ability of Army helicopter aircrew to make estimates of combat target closure and escape, and (2) the ability to anticipate and compensate for inherent time lags in target acquisition and interception tasks. Subjects will perform under smoking deprived conditions and comparison will be made to determine differential responses.

Two studies will be conducted. The first investigation will determine the effects of smoking and smoking deprivation on the ability to make estimates of closure and escape by performing a modified version of the velocity estimation task used in previous studies. The second investigation will look at performance of smoking and smoking deprived subjects on a task requiring precise integration of spatial and temporal information in order to predict the interception of a projectile and target.

ADDENDA: Supporting agency address is: MDRDC Environmental Protection Res Div, Ft Detrick, MD 21701

SUPPORTED BY U.S. Dept. of Defense, Army

6.0005, DEVELOPMENT OF IMPROVED METHODS FOR PREDICTING INVOLUNTARY SEPARATION
C.D. Gott, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Brooks Air Force Base, San Antonio, Texas* 78235 (DF233340)

To develop improved mathematical/statistical methods for predicting involuntary separation within the Air Force enlisted force and other success/fail criteria such as graduation/elimination from undergraduate pilot training (UPT), technical training, and basic military training (BMT). Generalize the resulting mathematical prediction system to improve predictability in other areas of the personnel system. Compare and evaluate the predictability of the motivational attrition prediction (MAP) model with other existing and/or newly developed prediction systems.

The MAP prediction model will be implemented and tested on AFHRL'S UNIVAC 1108 computer system. The original data base used by AFMPC/DPMYAA in developing MAP will be used by AFHRL to assure error-free implementation by duplicating the original study for which MAP was developed. Other already operational prediction systems and/or modified and improved new systems will be implemented and tested. For comparison purposes, the data base of approximately 15,000 recruits entering the Air Force in 1972 will be used. For this data base, the necessary predictor variables, such as history opinion inventory (HOI), aptitude scores, high school courses, demographic information, and attrition criterion data are already available. The final optimum prediction model will be used to generalize to prediction of other success/fail-type binary and/or categorical criteria. Milestones--Dec 77, implementation of MAP on U1100 computer system. Mar 78, reanalysis of 1972 AF accession data using MAP and other existing and/or modified prediction systems to arrive at the system with the optimum predictability. Jun 78, technical report comparison of multiple linear regression and MAP for prediction of involuntary separation. Apr 79, completion of systematic study to generalize to prediction of other success/fail criteria. Dec 79, technical report.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0006, INFLIGHT PHYSIOLOGICAL MONITORING/LIFE SUPPORT EQUIPMENT TESTING
J.T. Merrifield, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF319810)

There is currently a need to reassess life support system design criteria and investigate specific biomedical hazards of flight. To measure aircrew physiological response in actual flight environments is essential to this effort. Information is needed which will permit derivation of future breathing system design criteria, oxygen generation/storage requirements, facilitate in-flight testing and evaluation of life support equipment, and provide an index of aircrew workload/stress in representative flying roles. This effort provides for in-flight physiological monitoring of aircrew members. Previous accomplishments in this area are documented under work unit 7930-11-09.

An in-flight physiological data acquisition system (IFPDAS) providing magnetic tape record of selected environmental and physiological stresses of flight, has been developed and subsequently tested in USAFSAM environmental chambers, and on the human centrifuge. It provides continuous, simultaneous record of the crewmember's expiratory flow, inhaled/exhaled oxygen concentration difference, and electrocardiogram, together with records of maneuvering load (gz) and cabin altitude. A time code (IRIG-B) and cockpit voice communications are also recorded. The system consists of an instrumented oxygen mask and associated sensor/signal-conditioning/recorder circuitry, of sufficiently small size and weight to permit its installation in selected pockets of the crewmember's survival vest, or any easily accessible cockpit space. Three copies of the system exist. One is stationed at the US Navy Pacific Missile Test Center for flights on their aircraft. The other 2 are used for collecting data from USAF aircrews. An upgraded version of the IFPADS is presented being contracted with the specific goals of increased reliability, increased versatility, and ease of operation and is expected to be operational by June 1978.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0007, DEVELOPMENT OF A VARIABLE G-SENSITIVE POSITIVE PRESSURE REGULATOR
R.M. Shaffstall, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF323540)

To design, fabricate and test experimental g-sensitive positive pressure breathing (PPB) regulators which may be used to improve aircrew's, gz tolerance.

Several types of positive pressure breathing (PPB) regulators will be designed, fabricated, and tested in order to determine the optimum PPB relationship to onset of g and the g of the aerial combat maneuver. The first regulator will be designed, fabricated, and tested in-house and will be capable of infinite variability relative to PPB and the g environment. This variable experimental regulator will be used in work unit 7930-12-11 in order to define the best PPB relationship to g. Further PPB regulator development will include design of regulators with other controls (i.e., fluidics and mechanical) and refinement of the electronic PPB regulator to a flight-worthy model.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, NUMERICAL STUDY OF THE FLOW IN A SIMULATED WING-FUSELAGE JUNCTURE
W.R. Briley, Scientific Research Associates Inc., *Glastonbury, Connecticut* 06033 (DN775273; N00014-77-C-0075)

The development of accurate numerical methods to describe the flow about aircraft and missiles is essential for their design and optimization. This research will study, within the framework of the incompressible Navier-Stokes equations, the structure of the flow field in the vicinity of the intersection of a wall (with its accompanying boundary layer) and a wind rounded leading edge.

The flow in the vicinity of an airplane wing-fuselage juncture is extremely complex because, in addition to being three-dimensional, it usually involves both separation and the formation of vortices. These vortices can have a pronounced effect on the wing characteristics. Because of the complicated nature of the flow, analysis is of limited value and experiments would be both time consuming and costly. The present investigation isolates the juncture region as an element of the entire flow field. Within this element the flow will be studied by an alternating direction implicit method within the framework of the Navier-Stokes equations--the only reliable description of the flow.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

7.0002, APPLICATION OF NONLINEAR ANALYSIS
J.F. Auchmuty, Indiana University, Bloomington Campus, School of Arts & Sciences, Dept. of Mathematics, *Memorial Hall, Bloomington, Indiana* 47401 (MCS78-00952)

Renewal of MCS-7607273.

The investigator will study certain nonlinear mathematical problems arising in astronomy, biology, chemistry, and chemical engineering. These problems include the theory of reaction-diffusion equations and certain non-standard variational and optimization problems. The numerical solution of these problems will also be investigated.

SUPPORTED BY U.S. National Science Foundation, Div. of Mathematical & Computer Sciences

7.0003, WAVES IN TURBULENT MEDIA AND RANDOM LINEAR HYPERBOLIC SYSTEMS 15452-M

P.L. Chow, Wayne State University, School of Liberal Arts, Dept. of Mathematics, *4841 Cass Ave., Detroit, Michigan* 48202 (DA0F9164; DAAG29-78-G-0042)

To study wave propagation in time-dependent random media with special stress on effects of turbulence on the statistical properties of wave parameters. Relevance - study of time-dependent wave propagation is of practical importance to radio and optical communications systems. Specifically, the proposed work may provide better quantitative tools for measuring wave propagation of radio waves in the ionosphere and pulsed laser beams through the atmosphere.

Develop asymptotic and approximate methods for random partial differential equations.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

7.0004, NUMERICAL METHODS FOR COMPUTER SOLUTION OF ENGINEERING PROBLEMS

S.J. Parter, University of Wisconsin, Madison Campus, School of Natural Sciences, Dept. of Computer Sci, *Agriculture Hall, Madison, Wisconsin* 53706 (DN823218; N00014-76-C-0341)

Improvements in the design of both ships and aircraft and a better understanding of the Navy environment depend on more accurate and more rapidly obtainable numerical solutions to differential equations used for description, prediction, and control of physical phenomena. Such phenomena include fluid and gas dynamics, certain chemical reactions, and electrodynamic phenomena. The objective of this task is to develop accurate and efficient methods for the computer solution of differential equations which recur continually throughout engineering applications, with particular emphasis on fluid mechanics.

Both analytical results and numerical methods will be derived for two point boundary value problems (and singular perturbations thereof), nonlinear elliptic equations, free boundary value problems, and functional ordinary differential equations. Such problems often exhibit very delicate, and even pathological, behavior. Thus, an analytic understanding of the problems is often a necessary prelude to the development of successful numerical techniques.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, SURFACE PROPERTIES OF METALS AND SUBSTITUTIONAL ALLOYS AND THEIR RELATIONSHIP TO CATALYSIS

W.E. Spicer, Stanford University, School of Engineering, Dept. of Electrical Engin, *Stanford, California* 94305 (DMR77-23442)

This is a continuation of studies on surface composition electronic structure, chemisorption and surface reactions on bimetallic surfaces. The overall goal is to provide critical knowledge toward understanding surface reactivity and catalysis. Single crystals and bulk samples will be examined at low pressures by ultraviolet photoelectron spectroscopy with conventional light sources and also with synchrotron radiation, Auger electron spectroscopy, low energy electron diffraction, temperature programmed reactions and desorption. The results obtained at low pressures will be compared to catalytic activity measurements on small metal particles at pressures near one atmosphere. Specifically, reactions between H2 and preadsorbed oxygen at low pressures, will be studied, first on single crystals of Pd as a reference metal and then started on selected PdAu bimetallic bulk samples. These studies will help to understand previous catalytic studies pertaining to the reaction between H2 and O2 on small Pd and Pd/Au particles at high pressures. The combined experimental results will be used to elucidate the mechanism of the hydrogen-oxygen reaction, both at low and high pressure. A second bimetallic to be investigated is the Cu-Ni system which was extensively studied in the previous grant period. The research will be extended to include the effect of the bimetallic surface composition on the selectivity of the decomposition of formic acid to form CO and CO2. The results obtained on well-characterized single crystal surfaces at low pressures will be compared to those on small particles at high pressure. The combined data will be used to assess again the relationship between studies done on single crystals at low pressures to those done on small particles at high pressures. In addition experimental work will be done on formaldehyde and methanol decomposition on the Cu-Ni alloys.

To gather a more fundamental understanding of the interactions between metal and absorbed gases which is the essence of the catalytic process, a program recently initiated involving photoemission measurements (including angularly resolved work) and theoretical work will be continued. The prime objective of this work is to increase understanding of the relationship between the electronic structure of the metal and its interaction with the adsorbed gas. (Text Abridged)

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0002, THEORETICAL SOLID-STATE PHYSICS

M.L. Cohen, University of California, Berkeley Campus, School of Letters & Science, Dept. of Physics, *Berkeley, California* 94720 (DMR76-20647 A01)

Research previously supported under DMR72-03206 will be continued. A broad program in theoretical solid-state physics and material research in the fields of semiconductors (electrical and optical properties), superconductors, magnetic materials, surfaces, electron hole drops, amorphous solids and interactions of monopoles with crystals will be undertaken. The empirical pseudopotential method will be used in the calculation of the electronic properties of semiconductors and superconductors.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0003, EXPERIMENTAL STUDIES OF NORMAL METAL INTERACTIONS UTILIZING PROXIMITY EFFECT TUNNELING

P.M. Chaikin, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Physics, *405 Hilgard Ave., Los Angeles, California* 90024 (DMR78-12000)

This is a continuation of work sponsored under DMR-7608899. An experimental study will be made of normal metal interactions by means of proximity effect tunneling. For a variety of normal metals proximity effect tunneling will be used to obtain the phonon density of states, the electron-phonon interaction, the Fermi velocity, and energy dependent lifetimes in the normal metal. The spin glass transition, the effect of magnetic impurities in normal metals and non-equilibrium superconductivity in the proximity effect configuration will be studied. This work is important for understanding non-equilibrium super-conductivity and the proximity effect in normal metals.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0004, LOCALIZED MOMENTS AS SPIN LABELS IN SOLIDS

R.L. Orbach, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Physics, *405 Hilgard Ave., Los Angeles, California* 90024 (DMR76-82347 A02)

This research will be a continuation and extension of work begun under NSF Grant No. DMR72-02935. Magnetism and superconductivity will be studied in metallic thin films utilizing magnetic resonance, critical field measurements and conductivity measurements. The geometry of the samples will include both superconductor-normal composites (proximity effect sandwiches) and granular superconductors. The principal focus of the experiments will be on spin scattering rates in superconductors, the spatial dependence of the superconducting order parameter in prox-

imity effect sandwiches, and the fluctuation properties of granular superconductors which exhibit both zero and two-dimensional behavior. Two other areas of research also will be undertaken. Orbit-lattice interactions in thin films will be studied by electron spin resonance and susceptibility measurements and mixed valency will be studied for Eu ions in a LaRh2 matrix.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0005, THEORETICAL PARTICLE PHYSICS AND THEORY OF PHASE TRANSITIONS
M. Nauenberg, University of California, Santa Cruz Campus, Graduate School, Dept. of Chemistry, *Santa Cruz, California* 95060 (PHY78-22253)

This work is in the field of theoretical physics, with emphasis on problems in statistical mechanics and elementary particle physics. In particle physics, the topics include the study of topological properties of the non-abelian gauge theories, models of quark confinement in both lattice and continuum approximations, and phenomenology of hard proton scattering. In statistical mechanics, the renormalization group will be applied to various phase transitions, such as spin glass transitions which have not yet been fully understood. Finally, problems in high-energy astrophysics relating quantum field theory and general relativity will be pursued.

This is the first year of a three-year continuing grant, previously supported under NSF grant PHY76-18598A01.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0006, GROWTH OF SEMICONDUCTORS
H. Lessoff, U.S. Dept. of Defense, Navy, Naval Research Lab., *Washington, District of Columbia* 20375 (DN880010)

To purify starting materials, to develop processing technology and to grow bulk single crystals and epitaxial layers of semiconducting materials including those from groups IV, II-VI, and III-V needed by the Navy for solid-state electronic and electrooptic devices.

Single crystals of such materials are gallium arsenide, silicon, indium phosphide, gallium-indium-arsendide-phosphide, are grown by a variety of techniques including liquid encapsulated Czochralski, liquid and vapor phase epitaxy, and travelling solvent freezing. Various technologies are used for purification and compounding including high-pressure reaction, vapor baking, zone melting, vapor phase condensation, and vacuum transport. Novel techniques are continuously being sought to reduce the background impurity levels, to develop better doping methods, to increase crystal perfection and to develop new compounds having desirable optical, and semiconducting properties for Navy needs at the microwave, millimeter wave and optic wavelengths. New material combinations are being prepared for potential useful applications.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

8.0007, PARAMETRIC INSTABILITIES IN INHOMOGENEOUS PLASMAS
F.T. Adler, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Physics, *2527 Hydrosystems Lab., Urbana, Illinois* 61801

While instabilities in infinite homogeneous plasmas have been investigated extensively, only limited knowledge exists on the onset of parametric instabilities in inhomogeneous warm plasmas. In the hydrodynamic approximation the threshold for the onset of such instabilities and their temporal growth rates have been calculated for a warm, non-magnetic plasma. For this purpose a system of eigenfunction has been developed for a simple (slab) geometry that leads to a rapidly converging coupled mode expansion. These temporal modes are coupled through the parameters describing the spatial inhomogeneity of the finite plasma. The effects of a blow-off region around a fully or partially ionized plasma subject to an intense electromagnetic field are now being investigated along similar lines.

SUPPORTED BY University of Illinois

8.0008, ANHARMONIC EFFECT IN SOLIDS
A.V. Granato, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Physics, *2527 Hydrosystems Lab., Urbana, Illinois* 61801 (EY-76-C-02-1198)

Ultrasonic techniques are being used to determine symmetries, frequencies, and lattice coupling constants of dipolar point defects in metals. Defects under study at present are impurity-interstitial complexes in aluminimum and hydrogen in niobium. The former are important for the understanding of radiation damage in metals, while the latter are of particular interest for the quantum effects they display.

SUPPORTED BY U.S. Dept. of Energy, Unspecified Unit

8.0009, DEFECT INTERACTIONS IN CRYSTALS
A.V. Granato, University of Illinois, Urbana Champaign Campus, School of Liberal Arts & Sciences, Dept. of Physics, *Urbana, Illinois* 61801 (DMR77-10556 A01)

This research was previously supported under DMR 75-14726.

The main focus of this research is the investigation of dislocation-point defect interactions and the influence on these interactions of electrons, phonons and optical illumination. Ultrasonic attenuation will be studied in a variety of crystals in order to measure the nature of these interactions. Among the systems which will be investigated are (1) carbon in iron, (2) free interstitials in metals, (3) defects in irradiated metals and (4) impurity-interstitial complexes. The strength loss of superconductors and the strength increase of II-II compounds under optical illumination will be studied by means of ultrasonic measurements.

The development of theories to explain these effects will be continued. In particular, this will include the theory of long-range dislocation-point defect interactions and the effect of thermal fluctuations on amplitude-dependent internal friction.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0010, OPTICAL PROPERTIES OF SEMICONDUCTORS, MAGNETIC SEMICONDUCTORS AND FAR-INFARED EMISSION FROM SEMICONDUCTORS
H.Y. Fan, Purdue University, School of Science, Dept. of Physics, *Executive Bldg., West Lafayette, Indiana* 47907 (DMR77-24306)

Experimental studies of magnetic semiconductors and far-infrared emission from semiconductors doped with impurities will be carried out as an extension of research supported by DMR-7511178. The one-magnon and two-magnon Raman scattering processes have been observed and investigated in manganese oxide, cobalt oxide and cubic manganese sulfide. The change in the Raman scattering of phonons associated with the structural phase transition in di-vanadium trioxide has also been observed. Careful spectroscopic studies of the Raman scattering in di-vanadium trioxide will be carried out to determine the effects of various external conditions, such as strong magnetic fields, on the metal-insulator, structural and antiferromagnetic phase transitions in this material. Also, the studies of far-infrared emission from semiconductors containing shallow impurity levels will be continued. This effort will be directed toward obtaining stimulated emission. Experiments to determine the level of stimulation as a function of wavelength and to observe spatial coherence of the emission will be carried out.

This is the first year of a two-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0011, THEORY OF INTERACTING FERMI SYSTEMS
A.W. Overhauser, Purdue University, School of Science, Dept. of Physics, *Executive Bldg., West Lafayette, Indiana* 47907 (PRF 8699).

The anomalous properties of potassium have long been one of the outstanding unsolved problems in solid-state physics. The hypothesis of a charge density wave (CDW) ground state has been successful in explaining some of these anomalies. Because the vast majority of the theory of many particle systems does not predict the existence of CDW's, finding them in potassium would

call serious question to much of the current literature. Our goal has been to develop the first theory of the transport properties of CDW systems and to attempt to explain the anomalous transport properties of potassium.

We have microscopically examined in detail the effects of electric and magnetic fields and impurity scattering on CDW systems. From these considerations we have derived a set of simple equations governing the drift velocities of the CDW and the electrons.

We have completed the above derivation and have found that we cannot explain the experimental data under the assumption that the system contains a single drifting CDW.

There are still many questions which must be answered before the full applicability of our theory to potassium can be ascertained. We plan to examine the effects of CDW domain structure, the lattice periodicities, and the elementary excitations of the CDW.

SUPPORTED BY Purdue Research Foundation

8.0012, SOLID STATE STUDIES OF AMORPHOUS MAGNETIC SOLIDS

C. Chien, Johns Hopkins University, School of Arts & Sciences, Dept. of Physics, *34th & Charles Sts., Baltimore, Maryland* 21218 (DMR77-09598 A01)

Amorphous solids (lacking a periodic crystal structure) which exhibit magnetic order will be studied using Mossbauer spectroscopy as well as resistivity and magnetization measurements. The Mossbauer effect studies will allow investigation of the microscopic behavior in these materials and in particular, the distribution of magnetic moments (and hyperfine fields) over the atoms in the solid. A variety of iron-and rare earth-based materials will be studied under varying conditions of temperature, pressure and magnetic field in order to obtain the electronic structure and the magnetic exchange interactions in these amorphous solids. Effects due to spin waves and Kondo-type anomalies in the resistivity are found in amorphous solids and will be investigated.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0013, SOLID-STATE STUDIES USING THE MOSSBAUER EFFECT

J.C. Walker, Johns Hopkins University, School of Arts & Sciences, Dept. of Physics, *34th & Charles Sts., Baltimore, Maryland* 21218 (DMR77-07127 A01)

Mossbauer effect experiments will be carried out to observe the microscopic behavior in a variety of magnetic materials. The effects of sample thickness on the magnetic properties of ultrathin films will be examined. Epitaxially grown films of iron with thicknesses between 10 and 220A will be made with the critical temperature and the nature of the magnetic order to be measured using Mossbauer spectroscopy.

Some splat-cooled Fe40, Ni40, B20-type amorphous ferromagnets will be used to study the spin-wave behavior and the magnetic phase transition as well as the magnetostriction. Mossbauer measurements will be made using an rf sideband technique developed by Chien and Walker to measure the magnetostriction.

A study of iron-poor FePd alloys will be made in an attempt to establish a closer connection between the magnetic properties of disordered alloys and those of amorphous ferromagnets.

This is a continuation of research previously supported under DMR75-13354.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0014, SURFACE EFFECTS IN SMALL PARTICLES

R.C. Reno, University of Maryland, Baltimore County Campus, Graduate School, Dept. of Physics, *1420 N. Charles St., Catonsville, Maryland* 21201 (10033B5)

Hyperfine field studies of small metal particles by perturbed angular correlations.

SUPPORTED BY American Chemical Society

8.0015, HIGH-TEMPERATURE PLASMAS

D.A. Boyd, University of Maryland, College Park Campus, Graduate School, Dept. of Physics & Astronomy, *College Park, Maryland* 20742 (PHY77-26042)

Experimental and theoretical studies will continue of (a) the synchrotron radiation emitted by Tokamak plasmas, including use of the emitted radiation as a diagnostic tool for the plasma microstate, and (b) studies of the fundamental equilibrium, stability, and synchrotron radiation properties of magnetically confined nonneutral plasmas and plasmas characterized by intense self fields.

This is a continuation of work supported by NSF Grant PHY76-02565 A03.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0016, ROCKET INVESTIGATION OF ELECTRON PRECIPITATION TRIGGERED BY VLF EMISSIONS

D.L. Matthews, University of Maryland, College Park Campus, Inst. for Physical Science & Technology, *College Park, Maryland* 20742 (DPP77-22401)

In this NSF/NASA jointly sponsored project, three Nike-Tomahawk rockets will be instrumented with electron spectrometers to study the plasma physics of wave-particle interactions in the earth's magnetosphere. These rockets will be launched from Siple Station, Antarctica, during austral summer of 1978/79 in conjunction with balloon, satellite, ground-based, and other rocket observations of wave-particle interactions.

Logistics support at Siple Station is required for 14 people during December 1978 and January 1979.

Previous award No. is DPP-7503516 A02.

SUPPORTED BY U.S. National Science Foundation, Div. of Polar Programs

8.0017, PLASMA PHYSICS OF PELLET FUSION

D.A. Tidman, University of Maryland, College Park Campus, Inst. for Physical Science & Technology, *College Park, Maryland* 20742 (EY-76-S-05-5000)

Pellet fusion involves both the design of appropriate pellets and the development of a pulsed power technology (electron, ion, or laser beams) capable of igniting the pellets. We are investigating several plasma problems that arise in this field. Three areas under investigation are: (1) Various mechanisms are expected to generate magnetic fields in target pellets. The generation and evolution of these fields during deposition and compression are being analyzed. (2) Heavy ion beams in the 10-100 GeV range have been proposed for pellet ignition. We are developing a model for the propagation of one such focussed ion beam through the relatively dense gas that may exist in the target chamber of a reactor. Our model contains the effects of beam ion stripping, and background plasma generation by the beam ions, and electron avalanching in the electric fields produced by the ion pulse. Charge and partial current neutralization, together with stability conditions and the effects of pre-ionization will be calculated. (3) The production of hard X-rays by heavy multi-GeV ions slowing down in a high atomic weight target (e.g., the outer layer of a pellet) is being calculated.

SUPPORTED BY U.S. Dept. of Energy, Div. of Laser Fusion

8.0018, RESONANT MULTIPHOTON EXCITATION OF MOLECULES

A. Javan, Massachusetts Inst. of Technology, School of Science, Dept. of Physics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139

Utilizing a multiline CO2 laser to excite high-vibrational levels in a molecule, a study is being made of the redistribution of energy from one molecular energy level to the rest of the molecular energy manifold.

SUPPORTED BY Massachusetts Inst. of Technology

8.0019, LUMINESCENCE STUDIES OF DEFECTS IN LONE-PAIR SEMICONDUCTORS

M. Kastner, Massachusetts Inst. of Technology, School of Science, Dept. of Physics, 77 *Massachusetts Ave., Cambridge, Massachusetts* 02139 (DMR78-00836)

The models of Anderson, of Street and Mott, and of Kastner, Adler and Fritzsche explain qualitatively many of the electronic and optical properties of chalcogenide amorphous semiconductors. In particular, luminescence and related experiments seem to indicate well-defined defects in glasses which have the property that electrons on these defects possess a negative effective correlation energy because of strong electron-photon interaction. However, recent experiments indicate that a widely accepted model of the luminescence mechanism is inadequate. For example, Hudgens and Kastner, utilizing a new experimental technique, fatigue spectroscopy, showed that neutral excitations diffuse large distances in chalcogenide glasses. Experiments are underway to study the spatial diffusion and energy transfer processes in chalcogenide glasses. When combined with work on time-dependent spectroscopy of the luminescence, funded separately, a deeper and more quantitative picture of the luminescence and luminescence fatigue processes will emerge. Special attention is given to the structure of the defects involved in luminescence and fatigue, and development of experiments to demonstrate directly the sign of the effective correlation energy.

This is a continuation of work supported by DMR 76-11972. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0020, EXPERIMENTAL NUCLEAR SCIENCE

F.D. Becchetti, University of Michigan, Ann Arbor Campus, School of Literature Science & the Arts, Dept. of Physics, *Ann Arbor, Michigan* 48104 (PHY78-07754)

An experimental program to investigate clustering phenomena in nuclei with direct transfer reactions will be carried out at a number of accelerator facilities. These data will provide quantitative tests of current theoretical models of nuclear clustering. Related work involving nucleosynthesis and nuclear stability will also be done.

This work represents a continuation of that currently supported under Foundation grant PHY76-00287.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0021, APPLICATIONS OF FUNCTIONAL ANALYSIS IN ELEMENTARY PARTICLE PHYSICS AND STATISTICAL MECHANICS

P. Federbush, University of Michigan, Ann Arbor Campus, School of Literature Science & the Arts, Dept. of Physics, *Ann Arbor, Michigan* 48104 (PHY77-02187)

The investigator will continue a program of research involving rigorous applications of functional analysis in the quantum field theory of elementary particles, scattering theory and statistical mechanics. The major areas to be studied are: the exploitation of a constructive-field-theory-like cluster expansion in statistical mechanics, Euclidean field theory methods for fermions, and other related applications in statistical mechanics including correlation inequalities. This work is a continuation of that supported by Foundation grant PHY75-10751 A01.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0022, APPROXIMATION PROCEDURES IN GENERAL RELATIVITY AND RELATIVISTIC TRANSPORT THEORY OF MULTI-COMPONENT SYSTEMS

J.L. Anderson, Stevens Inst. of Technology, Graduate School, Dept. of Physics, *Castle Point, New Jersey* 07030 (PHY77-11687)

Theoretical research on gravitation and relativity initiated under grant PHY75-07797 A01 will be continued. Particular topics to be investigated include: 1. Approximation methods in general relativity. 2. Relativistic kinetic theory of multi-component systems.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0023, STUDY OF ENERGY CONVERSION AND TRANSPORT IN SPACE PLASMAS

W.C. Feldman, U.S. Dept. of Energy, Los Alamos Scientific Lab., *P.O. Box 1663, Los Alamos, New Mexico* 87544 (E513)

A program of experimental theoretical basic research on the plasma and heavy ion physics of the solar wind, lower solar corona, and earth's bow shock and magnetopause, with particular attention to problems which have relevance to CTR, will be carried out.

SUPPORTED BY U.S. Dept. of Energy

8.0024, ELECTRONIC STRUCTURE AND SPIN-RESOLVED K-SPACE SPECTROSCOPY IN METALS

D.H. Lowndes, Oregon State Higher Education System, University of Oregon, School of Liberal Arts, Dept. of Physics, *1472 Kincaid St., Eugene, Oregon* 97401 (DMR78-06271)

This research was previously supported under DMR-7407652.

Improved resolution of the de Haas-van Alphen technique will be used in studies of electronic structure in a variety of metals. These studies include an investigation of the onset of ferromagnetism in a metal with dilute magnetic impurities; an investigation of the connection between the electronic structure and the A-15 structural phase transition in superconducting Nb3Sn and V3Si; and an investigation of the electronic structure in the La(Gd,Ce)Al2 system in which superconductivity may coexist with a magnetic state. Experiments will also be carried out in single crystals of mercury to investigate the quenching of the electron-phonon mass enhancement by an intense magnetic field. Large magnetic field-dependent increases in electron-impurity scattering will be studied by examination of the line shape from single quantum oscillations. Experiments will be continued to investigate the combined effects of Fermi surface geometry and the spin-orbit interaction in order to understand the origin of large shifts in the electronic g-factor.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0025, NUCLEAR RESEARCH WITH TANDEM ACCELERATOR

R. Middleton, University of Pennsylvania, School of Arts & Sciences, Dept. of Physics, *34th & Spruce Sts., Philadelphia, Pennsylvania* 19104 (PHY78-01396)

This is a continuation of research presently supported under PHY77-03852 AO1. A program of Nuclear Science studies will be carried out using an upgraded FN Tandem Van de Graaff accelerator. Work will continue using a tritium source developed at the University of Pennsylvania to study a variety of (t, beta) and (t, alpha) reactions on nuclei ranging from 9Be to 209Bi. However emphasis will be on light nuclei. Also (t, p gamma) studies using coincidence methods will be carried out. Lifetimes for beta-decay of nuclei produced by the (t,p) reaction will be studied using a beam chopper. Spin assignments of levels in 20 He and 24 Mg will be carried out using 12C(12C, alpha) and 17C(16O alpha) reactions. Work in heavy ion reactions using silicon and calcium targets and beams will study high spin states. Angular correlations using (d, p gamma) reactions will give information on the details of nuclear reaction mechanisms. Some applications of nuclear techniques to astrophysics and archeology will be pursued.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0026, ATOMIC STRUCTURE AND COLLISIONS EXPERIMENTS ON HIGHLY IONIZED IONS

D.J. Pegg, University of Tennessee, Knoxville Campus, School of Liberal Arts, Dept. of Physics & Astronomy, *W. Cumberland Ave. S.W., Knoxville, Tennessee* 37916 (PHY77-05726)

Research on heavy-ion atomic structure and associated collision phenomena will be continued. In general, the experimental investigations involve the interaction of accelerated ion beams (often highly stripped) with both solid and gaseous targets. Charge-changing processes and the deexcitation of excited electronic states by both photon and electron emission are used to 'signature' the occurrence of specific collision and radiative phenomena in the target or projectile. In this manner collision cross sections and radiative and autoionizing decay probabilities are measured. In order to span as wide a range of projectile energies, charge states, and species as possible, several different particle accelerators are employed. The group works primarily at the Oak Ridge National Laboratory in the capacity of a university user's group. Experiments are also performed at the University of Tennessee, Brookhaven National Laboratory and occasionally at other sites.

During the next grant period four different kinds of investigations are planned: (1) Structure and Lifetimes of Highly Ionized Ions using Beam-Foil Excitation, (2) Collision and Structure Experiments on Low-Energy Multiply Charged Ions, (3) Collisional Production and Electron Spectroscopy of Core-Excited States of Alkali-Like Systems, (4) Electron Capture by High-Energy Protons in Atomic Hydrogen (in collaboration with J.E. Bayfield and colleagues).

This work is a continuation of that currently supported under NSF grant number MPS72-05159 A01.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0027, THE ROLE OF GRAVITATION IN PHYSICS

B.S. Dewitt, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Physics, *200 W. 21st St., Austin, Texas* 78712 (PHY77-22489)

Research initiated on NSF grant PHY74-03563 A03 will continue on the role of gravitation in physics, at the quantum level and in the realm of astrophysics. The specific problems to be undertaken are: 1. Computer calculations of (a) collapsing spherical and nonspherical, rotating and nonrotating distributions of matter, (b) the formation of black holes, and (c) the gravitation radiation emitted. Standard polytropic equations of state will be used. The computer will also be used to study maximal slicings of the Kerr geometry. 2. A study of the vacuum stress (vacuum polarization) in strong gravitational fields, in accelerating frames, and in regions with curved boundaries. 3. Further study of quantum field theory in curved spacetime. 4. Differential geometry, Lie group theory and fibre-bundle theory on Z-graded algebras. 5. Further development of quantum theories of gravity and supergravity. 6. Topics in classical relativity.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0028, RESEARCH IN ELEMENTARY PARTICLE THEORY

E.C. Sudarshan, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Physics, *200 W. 21st St., Austin, Texas* 78712 (EY-76-S-05-3992)

The Center for Particle Theory's primary research mission is investigating the fundamental structure of matter. It proposes to carry out this research through a broad program of techniques currently utilized in elementary particle physics. Investigations of the fundamental quantum field theoretic method of the elementary particle interactions involves full understanding of the quantum measurement problem. In addition, whatever quantum field theoretical methods develop they must be applied to ongoing high energy experimental phenomenology. Therefore, a program using quantum field theories for the phenomenology of weak and electromagnetic interactions is proposed. Elementary particle physics developments have recently been shown to have important implications in current astrophysical problems. A program in extending the application of particle physics methods to Astrophysics will be continued. Recently the discovery of gauge fields has indicated the possibility of a unified theory of strong, weak, electromagnetic and gravitational force systems. A significant program in developing these supersymmetric theories of matter is currently underway at Texas. The methods of group theory analysis applied to particle phenomena has long been identified with the group at Texas. This program and its algebraic counterpart will continue.

SUPPORTED BY U.S. Dept. of Energy, Div. of High Energy & Nuclear Physics

8.0029, SURFACE CRYSTALLOGRAPHY AND ELECTRONIC STRUCTURE OF METALS AND SEMICONDUCTORS

S.Y. Tong, University of Wisconsin, Milwaukee Campus, School of Letters & Science, Dept. of Physics, *Pearse Hall, Room 107, Milwaukee, Wisconsin* 53201 (DMR77-28112)

Professor Tong is developing theories and calculational methods for extracting information on the geometric and electronic structures of surfaces from Low Energy Electron Diffraction (LEED) and from Angle Resolved Ultraviolet Photoemission Spectroscopy (ARUPS) data. Effective collaborations have been established with experimental laboratories that produce these data. For interpreting LEED data, Tong has developed two methods: the Combined Space Method permits accurate interpretation of LEED data for surfaces in which atoms are as much as 0.07 nm out of plane from one another; and, the Quasidynamical Method permits calculations of structures in which reconstruction (i.e., the surface structure is different from that of the bulk) extends by as much as 5 to 7 monolayers into the bulk. These methods are being extended and applied, for instance, to clean and arsenic-covered gallium arsenide, to different surfaces of silicon, and to hydrogen and larger molecules on metal surfaces.

For interpretation of ARUPS data, Tong and coworkers have developed the Multiple Scattering approach, which takes into account all of the factors that influence the angular distribution of the emitted electrons. Important among these processes is the multiple scattering of the low energy electron as it leaves the surface species. This method is being extended and applied to data for chalcogenide (oxygen, sulfur,....) atoms or small molecules on transition metal surfaces.

This is the first year of a three-year continuing grant. This is a continuation of research supported by DMR 73-02614.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, HYDRODYNAMIC STUDIES OF THE NOVA OUTBURST AND RELATED OBJECTS

S.G. Starrfield, Arizona State University, School of Liberal Arts, Dept. of Physics, *Tempe, Arizona* 85281 (AST77-23190)

This research will be concerned with the cause and evolution of the nova outburst. Calculations will be made concerning the behavior of the material that is ejected from the star and the effect of accretion of material on the characteristics of the nova outburst. Thermonuclear reactions in the envelopes of neutron stars will be studied in an attempt to understand the transient X-ray sources that have been observed. Accretion of material onto neutron stars will be examined. There will be work concerned with the cause of the nova outburst and a study will be made of the effects of variations in the helium to hydrogen abundance ratio on the nova and dwarf nova phenomenon. An investigation of oscillations of novae will be made.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0002, AN EMISSION-LINE ANALYSIS OF NOVAE SHELLS

R.E. Williams, University of Arizona, School of Liberal Arts, Dept. of Astronomy, *Tucson, Arizona* 85721 (AST77-15865)

An observational and theoretical study of spatially resolved novae shells will be carried out. The emission-line fluxes will be determined for a number of known novae shells in order to

establish element abundances and excitation conditions in the gas. Knowledge of these parameters will be helpful in understanding the nature of the nova outburst. Theoretical models of shells will be constructed, including the effects of interaction of the shell material with the accretion disk, and line fluxes will be computed and compared with those observed. The time evolution of the nebular spectrum will be followed. In particular studies will be made of a) whether there is an enhancement of carbon, nitrogen, and oxygen enhancement in the novae shells, b) what differences exist between shells associated with fast and slow novae, c) the extent to which the accretion disk interacts with the shell, d) typical geometries for the shells, and e) the ultraviolet radiation field of the degenerate dwarf star.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0003, DETECTION, SPECTROSCOPY AND PHYSICAL STUDY OF RADIO GALAXIES AT LARGE RED SHIFTS
H. Spinrad, University of California, Berkeley Campus, School of Letters & Science, Dept. of Astronomy, *Berkeley, California* 94720 (AST77-26897)

The main research objective is to study the evolution of galaxies at large red shifts (and long look-back times), and to constrain current cosmological models by means of optical observations of distant radio and cluster galaxies. The procedures require detection of limiting (V greater than or equal to 23) galaxies (radio sources or cluster members), followed up by (presently) lengthy and difficult spectrophotometry. This research then yields a red shift and color-evolution data. In a few cases, galaxy surface-brightnesses and isophotal diameters will be measured; such data will be utilized for an evaluation of galaxian luminosity evolution, if qo (the deceleration parameter) can be independently fixed. Finally the probable content of a sample of faint field galaxies will be discussed.

This is a continuation of research done under grant AST 72-05061 A04.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0004, SOME CURRENT PROBLEMS IN STELLAR AND NEBULAR CHEMICAL COMPOSITIONS
L.H. Aller, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Astronomy, *405 Hilgard Ave., Los Angeles, California* 90024 (AST77-21022)

Solar abundances of elements of special interest in meteoritic and geochemical applications will be determined and new techniques for abundance studies in our own and other galaxies will be exploited.

In particular, the method spectrum synthesis will be applied to the far ultraviolet solar spectrum and also to the Magellanic Cloud supergiants if suitable data can be secured. It is essential to compare stellar chemical compositions with those of associated ionized hydrogen (HII) regions.

Current spectroscopic observations of gaseous nebulae emphasize the weaker and heretofore less well observed radiations. These data permit more thorough plasma diagnostics as well as investigations of less abundant elements and should allow construction of better models for galactic gaseous nebulae. Insights provided by such investigations should improve analyses of HII regions in other galaxies. An analysis to find how much of observed spectroscopic differences require interpretation as abundance effects and how much can be explained as excitation effects will be carried out. Finally, the question of how abundance differences are related to evolutionary history of associated stars and interstellar medium will be investigated.

This is a continuation of research done under grant AST 76-21457.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0005, ZODIACAL STAR CATALOG
G.G. Douglass, U.S. Dept. of Defense, Navy, Naval Observatory, *Washington, District of Columbia* 20390 (DN794602)

Astronomical observations leading to a precise reference grid of stellar positions in a zodiacal band, 18 degrees wide centered on the ecliptic, constitute fundamental input to the study of lunar, planetary, and satellite motions within the solar system, and to navigation and celestial prediction in which the Naval Observatory has a Department of Defense-directed requirement.

Astronomical photographs of stars down to 12.5 magnitude are taken with a twin 8 in., f:10 astrograph in blue and yellow light. The plates are measured with an automatic measuring engine to yield the required stellar positions.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Observatory

10.0006, ASTRONOMICAL DETECTOR DEVELOPMENT
T.B. McCord, University of Hawaii System, Manoa Campus, Inst. for Astronomy, *2840 Kolowala St., Honolulu, Hawaii* 96822 (AST76-81803 A01)

This grant will provide funds to enable silicon target (ST) vidicon and intensified silicon vidicon (SIT) image acquisition systems which have been developed at the Massachusetts Institute of Technology to be adapted to auxiliary instrumentation of the 2.24 meter telescope of the Mauna Kea Observatory of the University of Hawaii.

These systems will be used for a number of scientific programs at the Mauna Kea Observatory. These programs include observations of the ultraviolet emission features in T Tauri-type stars, the structure of the atmospheres of the major planets, line profiles in early type stars, and investigations of certain characteristics of galaxies and quasi-stellar objects.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0007, THEORETICAL STUDIES IN NUCLEAR SYNTHESIS AND ASTROPHYSICS
A.G. Cameron, Harvard University, Cambridge Campus, School of Arts & Sciences, Dept. of Physics, *Cambridge Station, Cambridge, Massachusetts* 02138 (AST77-25656)

Topics in stellar, nuclear, and galactic astrophysics will be examined. Three principal areas of investigation will be: 1) The r-process in nuclear astrophysics (the synthesis of neutron-rich heavy nuclei in nature). Most preceding work on this problem has concentrated on finding combinations of nuclear and astrophysical parameters which will fit the solar system abundance distributions of the r-process nuclides. The present investigation will attempt to determine how the r-process operates under a wide range of values for various parameters. 2) The evolution of stars before they begin to burn hydrogen. This project will examine some of the effects which influence the very early evolution of the star. 3) The interaction between stars and gas in a dense galactic core. This problem may be related to the quasar phenomenon. It is often postulated that the quasar phenomenon is associated with the very dense stellar cores of compact galaxies. Calculations indicate that stars can gain or lose mass rapidly. This process will be examined in order to see if it can enhance the supernova rate.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0008, STUDIES OF NEARBY LUMINOUS STARS IN GALAXIES
R.M. Humphreys, University of Minnesota, Minneapolis Campus, School of Liberal Arts, Depts. of Physics & Astronomy, *322 Johnston Hall, Minneapolis, Minnesota* 55455 (AST78-18398)

In recent years, the most luminous supergiants have become important steps in the determination of the extragalactic distance scale. However, very little fundamental information is available for these important stars, particularly outside our own galaxy. The primary purpose of this research is to obtain basic data, including spectra, for classification and photometry of individual stars in the Local Group galaxies. These observations have application to a number of current problems, including the cosmic distance scale and the progress of stellar evolution in different galaxies. These and other questions will be studied. In addition to observations of individual stars in the nearest galaxies, some aspects of

the properties of the Population I stars such as the blue to red supergiant ratio can be studied in more distant spirals.

This research program is a continuation of AST76-09082A01.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0009, ASTRONOMICAL RESEARCH IN PROPER MOTIONS

W.J. Luyten, University of Minnesota, Minneapolis Campus, Space Science Center, *Morrill Hall, Minneapolis, Minnesota* 55455 (AST77-13847)

This award supports the continuation and completion of a general catalog of proper-motion stars over the whole sky with angular motions equal to or greater than 0.5 seconds of arc per year. These data are being assembled from researches of the Principal Investigator and all published sources. The main activity will be the preparation of finding charts to assist would-be observers of these approximately 4000 large proper-motion stars for investigations of other parameters of astrophysical interest. Assistance in this work will be furnished by Dr. Henry Albers with support by a companion grant. Additional attention will be given to the completion of the provisional catalog, already assembled, including the correction of entries where necessary. Support is included for the publication of the catalog and finding charts in an astronomical periodical, for wide dissemination of this important information on the stars of the solar neighborhood.

Prior support was by NSF grant AST73-05241 A01.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0010, INTERMEDIATE PHOTOMETRIC CLASSIFICATION OF AFGL INFRARED SURVEY SOURCES

E.P. Ney, University of Minnesota, St. Paul Campus, Graduate School, Dept. of Physics & Astronomy, *St. Paul, Minnesota* 55101 (DF248020; F19628-76-C-0287)

AF function - target detection, discrimination, early warning, acquisition and terminal guidance. Deficiency - the capability of infrared sensors to acquire, detect and track targets against the natural background is significantly affected by the character of the spectral distribution of energy from the background objects. Objective -to obtain intermediate spectral bandpass measurements of a significant number of sources in the AFCFL Infrared Sky Survey catalog. How research contributes - these measurements will provide low resolution photometric spectral information from .5 microns to 18 microns on a significant number of AFCRL survey sources. These data will permit sorting the sources into classes, which will improve the existing AFCRL backgrounds model. Additional information as to time and spectral variation of some of the more unusual objects will be obtained.

This project will obtain 12 color measurements with a resolution of less than one micron with a liquid helium-cooled infrared sensors mounted on the O'Brien Observatory 30-inch telescope.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory OP L G Hanscom AFB, Bedford, Mass 01730

SUPPORTED BY U.S. Dept. of Defense, Air Force

10.0011, CONTINUUM OBSERVATIONS OF RADIO SOURCES AT 2 MM WAVELENGTH

J.R. Cogdell, University of Texas, Austin Campus, School of Engineering, Dept. of Electrical Engin, *200 W. 21st, Austin, Texas* 78712

DESCRIPTION: Recent advances in the sensitivity of radio receivers at high microwave frequencies have made possible observations of radio sources in the 2mm atmospheric window at the Millimeter Wave Observatory. Such observations are being made cooperatively with the planetary program described in collaboration with Dr. Beverly Wills of the Astronomy Department.

Sources observed include quasistellar objects (QSO's), Galactic H11 regions, supernova remnants, the galactic center, radio and IR galaxies, and variables such as BL Kac, and certain observatories for the variable objects. The purpose is to extend the spectra of these objects and bridge the gap between the cm-microwave and the infrared measurements. Predictions of outbursts of certain variables are also a goal.

SUPPORTED BY University of Texas

10.0012, THE MARTIAN CARTOGRAPHIC COORDINATES AND THE ROTATIONAL ELEMENTS OF MARS

G.H. Devaucouleurs, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Astronomy, *200 W. 21st St., Austin, Texas* 78712 (AST76-81090 A01)

The ephemeris for physical observations of Mars, in the national ephemerides, is based on the coordinates of the north pole of Mars, its rotational period, and the value for the longitude of the central meridian at a selected epoch. Extensive new data from radar observations and by direct imaging from spacecraft have made accurate cartography of the Martian surface possible. To use this as a basis for the physical ephemeris of Mars, it is essential to relate the new cartographic coordinates rigorously to the rotational elements.

The International Astronomical Union has recommended a new set of physical elements of Mars be adopted and a new physical ephemeris of Mars based on these elements be published when two critical unknowns have been determined: 1) An improved value for the rotation period of Mars from the past 3 centuries of observations, and 2) The relation between the traditional system of areographic coordinates and the new system adopted for the Mariner 9 cartographic results.

This investigation will complete the analysis of central meridian transits and areographic longitude data for the period 1877-1971 and extend it to the period 1659-1875, to derive a definitive value for the rotation period of Mars, also make detailed comparisons between the coordinates of surface features from telescopic observations and from Mariner 6, 7, and 9 to establish the zero-point differences between the old and new systems.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

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VOLUME 17 NUMBER 6 / MARCH 23, 1979

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERONAUTICS (GENERAL)

N79-14994* National Aeronautics and Space Administration, Washington, D. C.

AERONAUTICAL ENGINEERING: A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 103, DECEMBER 1978

Dec. 1978 136 p

(NASA-SP-7037(103)) Avail: NTIS HC E02 CSCL 01A

This bibliography lists 457 reports, articles, and other documents introduced into the NASA scientific and technical information system in November 1978. Author

N79-14995# Committee on Science and Technology (U. S. House).

FIRST A IN NASA

Washington GPO 1978 273 p refs Hearings before the Subcomm. on Transportation, Aviation and Weather of the Comm. on Sci. and Technol., 95th Congr., 2d Sess., 25-27 Jul. 1978 (GPO-33-709) Avail: Subcomm. on Transportation, Aviation and Weather

The future holds both challenge and opportunity for aeronautical research and technology, and the development of more effective economic transportation systems and superiority in military capability depends to a large part on NASA, the nature and quality of NASA's response and relationship with the aviation industry and other government agencies. Future opportunities for research and technology and long range planning identified by NASA include aerodynamics; materials and structures; propulsion; avionics, controls, and flight operations; and safety. Advances in computational aerodynamics and wind tunnel testing are reviewed. Needed future directions as determined by members of the aviation industry are also discussed. A.R.H.

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N79-14996*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

THEORETICAL STUDY OF VTOL TILT-NACELLE AXISYMMETRIC INLET GEOMETRIES

J. Dennis Hawk and Norbert O. Stockman Jan. 1979 29 p refs

(NASA-TP-1380; E-9756) Avail: NTIS HC A03/MF A01 CSCL 01A

A systematic theoretical study of VTOL tilt-nacelle inlet design parameters is reported. The parameters considered are internal-lip contraction ratio, internal-lip major-to-minor axis ratio, diffuser-exit-area to throat-area ratio, maximum diffuser wall angle and shape. Each of the inlets was analyzed at the same given flow condition of free-stream velocity, angle between the free stream and centerline of the inlet, and diffuser-exit Mach number. The effects of these geometric parameters on surface static-pressure distribution, peak surface Mach number, diffusion velocity ratio, and tendency for the inlet flow to separate are presented. Author

N79-14997*# Arizona Univ., Tucson. Engineering Experiment Station.

A NEW METHOD FOR DESIGNING SHOCK-FREE TRANSONIC CONFIGURATIONS

H. Sobieczky, K-Y. Fung, A. R. Seebass, and N. J. Yu Jul. 1978 35 p refs Presented at the AIAA 11th Fluid and Plasma Dyn. Conf., Seattle, 10-12 Jul. 1978

(Grant NsG-2112; Contract N00014-76-C-0182; Grant AF-AFOSR-2954E-76)

(NASA-CR-158063; Paper-78-114; TED-78-04) Avail: NTIS HC A03/MF A01 CSCL 01A

A method for the design of shock free supercritical airfoils, wings, and three dimensional configurations is described. Results illustrating the procedure in two and three dimensions are given. They include modifications to part of the upper surface of an NACA 64A410 airfoil that will maintain shock free flow over a range of Mach numbers for a fixed lift coefficient, and the modifications required on part of the upper surface of a swept wing with an NACA 64A410 root section to achieve shock free flow. While the results are given for inviscid flow, the same procedures can be employed iteratively with a boundary layer calculation in order to achieve shock free viscous designs. With a shock free pressure field the boundary layer calculation will be reliable and not complicated by the difficulties of shock wave boundary layer interaction. Author

N79-14998*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

AERODYNAMIC PERFORMANCE OF SCARF INLETS

John M. Abbott 1979 22 p refs Presented at 17th Aerospace Sci. Meeting, New Orleans, La., 15-17 Jan. 1979; sponsored by AIAA

(NASA-TM-79055; E-9865) Avail: NTIS HC A02/MF A01 CSCL 01A

A scarf inlet is characterized by having a longer lower lip than upper lip leading to both aerodynamic and acoustic advantages. Aerodynamically, a scarf inlet has higher angle of attack capability and is less likely to ingest foreign objects while the aircraft is on the ground. Acoustically, a scarf inlet provides for reduced inlet radiated noise levels below the engine as a result of upward reflection and refraction of inlet radiated noise. Results of a wind tunnel test program are presented which illustrate the aerodynamic performance of two different scarf inlet designs. Based on these results, scarf inlet performance is summarized in a way to illustrate the advantages and limitations of a scarf inlet compared to an axisymmetric inlet. Author

N79-14999*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EFFECT OF LIP AND CENTERBODY GEOMETRY ON AERODYNAMIC PERFORMANCE OF INLETS FOR TILTING-NACELLE VTOL AIRCRAFT

Richard R. Burley 1979 27 p Presented at the 7th Aerospace Sci. Meeting, New Orleans, 15-17 Jan. 1979; sponsored by AIAA

(NASA-TM-79056; E-9866; AIAA-Paper-79-0381) Avail: NTIS HC A03/MF A01 CSCL 01A

Inlets for tilt-nacelle VTOL aircraft must operate over a wide range of incidence angles and engine weight flows without internal flow separation. Wind tunnel tests of scale model inlets were conducted to evaluate the effectiveness of three geometric variables to provide this capability. Increasing the lip contraction ratio increased the separation angle at all engine weight flows. The optimum axial location of the centerbody occurred when its leading edge was located just downstream of the inlet lip. Compared with a short centerbody, the optimum location of the centerbody resulted in an increase in separation angle at all engine weight flows. Decreasing the lip major-to-minor-axis ratio increased the separation angle at the lower engine weight flows. Author

N79-15000*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

SONIC-BOOM MINIMIZATION WITH NOSE-BLUNTNESS RELAXATION

Christine M. Darden Jan. 1979 53 p refs

(NASA-TP-1348; L-12464) Avail: NTIS HC A04/MF A01 CSCL 20A

A procedure which provides sonic-boom-minimizing equivalent area distributions for supersonic cruise conditions is described. This work extends previous analyses to permit relaxation of the extreme bluntness required by conventional low-boom shapes and includes propagation in a real atmosphere. The procedure provides area distributions which minimize either shock strength or overpressure. Author

N79-15001*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

A REVIEW OF AT REST DROPLET GROWTH EQUATIONS FOR CONDENSING NITROGEN IN TRANSONIC CRYOGENIC WIND TUNNELS

Robert M. Hall and Susan A. Kramer Jan. 1979 38 p refs

(NASA-TM-78821) Avail: NTIS HC A03/MF A01 CSCL 01A

Droplet growth equations are reviewed in the free-molecular, transition, and continuum flow regimes with the assumption that the droplets are at rest with respect to the vapor. As comparison calculations showed, it was important to use a growth equation designed for the flow regime of interest. Otherwise, a serious over-prediction of droplet growth may result. The growth equation by Gyarmathy appeared to be applicable throughout the flow regimes and involved no iteration. His expression also avoided the uncertainty associated with selecting a mass accommodation coefficient and consequently involved less uncertainty in specifying adjustable parameters than many of the other growth equations. J.A.M.

N79-15002# California Inst. of Tech., Pasadena. Graduate Aeronautical Labs.

DYNAMICS OF VORTICES AND SHOCK WAVES IN NONUNIFORM MEDIA Annual Technical Report, 1 Jul. 1977 - 30 Jun. 1978

B. Sturtevant and V. Kulkarny 30 Jun. 1978 15 p refs

(Contract F49620-77-C-0107; AF Proj. 2307)

(AD-A060359; GALCIT-134B; AFOSR-78-1403TR) Avail: NTIS HC A02/MF A01 CSCL 20/4

Instrumentation systems and measurement techniques have been developed for studying shock-produced vortex rings, and preliminary measurements have been made. The project is designed to focus on the mechanisms of turbulence production and damping in vortex rings and on the mechanisms of vortex-ring instability. These processes are currently of great interest in the effort to understand how large-scale, coherent motions which occur in vortex rings and shear layers contribute to dissipation and mixing at small scales. The work is directed at studying the properties of high-energy vortex rings prior to the occurrence of instability, and also certain characteristics of the instability as it occurs in very strong vortex rings. GRA

N79-15003# Iowa Inst. of Hydraulic Research, Iowa City.

THREE-DIMENSIONAL BOUNDARY LAYERS ON BODIES OF REVOLUTION AT INCIDENCE Final Report

V. C. Patel and B. R. Ramaprian 30 Sep. 1978 12 p refs

(Grant DAAG29-76-G-0036)

(AD-A060469; ARO-13054.3-E) Avail: NTIS HC A02/MF A01 CSCL 20/4

This report summarizes the objectives and accomplishments of an experimental and theoretical investigation of the boundary layer development on bodies of revolution at incidence. The results of the flow visualization studies in laminar flow, detailed measurements in a turbulent boundary layer, and calculations of laminar as well as turbulent boundary layers using two different numerical schemes and turbulence models are reviewed to emphasize the important characteristics of separation in three dimensions. GRA

N79-15004# Boeing Vertol Co., Philadelphia, Pa.

INTERACTIONAL AERODYNAMICS OF THE SINGLE ROTOR HELICOPTER CONFIGURATION. VOLUME 2-E: HARMONIC ANALYSES OF AIRFRAME SURFACE PRESSURE DATA, RUNS 15-22, MID-SECTION Final Report, 15 Mar. 1977 - 13 Feb. 1978

Philip F. Sheridan Sep. 1978 152 p

(Contract DAAJ02-77-C-0020; DA Proj. 1L2-62209-AH-76)

(AD-A060868; USARTL-TR-78-23B-Vol-2-E) Avail: NTIS HC A08/MF A01 CSCL 01/3

This is the fifth of the nine-sub-volumes of Volume 2. These documents contain harmonic analyses of the waveforms generated by each of the 53 pressure transducers, which covered the surface of the model fuselage and empennage. This sub-volume covers the second eight of the twenty-seven runs devoted to surface pressure testing. The analyses encompass the transducers in the middle section of the model. Test conditions and/or configurations include effects of root cut-out, vortex generators and strakes, autorotation, and rotor height. Author (GRA)

N79-15005# Boeing Vertol Co., Philadelphia, Pa.

INTERACTIONAL AERODYNAMICS OF THE SINGLE ROTOR HELICOPTER CONFIGURATION. VOLUME 2-H: HARMONIC ANALYSES OF AIRFRAME SURFACE PRESSURE DATA, RUNS 23-23, MID SECTION Final Report, 15 Mar. 1977 - 13 Feb. 1978

Philip F. Sheridan Sep. 1978 202 p

(Contract DAAJ02-77-C-0020; DA Proj. 1L2-62209-AH-76)

(AD-A060869; USARTL-TR-78-23B-Vol-2-H) Avail: NTIS HC A10/MF A01 CSCL 01/3

This is the eighth of the nine sub-volumes of Volume 2. These documents contain harmonic analyses of the waveforms generated by each of the 53 pressure transducers, which covered the surface of the model fuselage and empennage. This sub-volume covers the final eleven of the twenty-seven runs devoted to surface pressure testing. The analyses encompass the transducers in the middle section of the model. Test conditions here involve speeds from 20 knots to 160 knots in level flight. Author (GRA)

N79-15006# Boeing Vertol Co., Philadelphia, Pa.

INTERACTIONAL AERODYNAMICS OF THE SINGLE ROTOR HELICOPTER CONFIGURATION. VOLUME 2-I: HARMONIC ANALYSES OF AIRFRAME SURFACE PRESSURE DATA, RUNS 23-33, AFT SECTION Final Report, 15 Mar. 1977 - 13 Feb. 1978

Philip F. Sheridan Sep. 1978 201 p

(Contract DAAJ02-77-C-0020; DA Proj. 1L2-62209-AH-76)

(AD-A060870; USARTL-TR-78-23B-Vol-2-I) Avail: NTIS HC A10/MF A01 CSCL 01/3

This is the ninth of the nine sub-volumes of Volume 2. These documents contain harmonic analyses of the waveforms generated by each of the 53 pressure transducers, which covered the surface of the model fuselage and empennage. This sub-volume covers the final eleven of the twenty-seven runs devoted to surface pressure testing. The analyses encompass the transducers in the aft section of the model. Test conditions here involve speeds from 20 knots to 160 knots in level flight. Author (GRA)

N79-15007# Army Armament Research and Development Command, Dover, N. J. Cost Analysis Div.

INTERACTIVE COMPUTER PROGRAM FOR LEARNING

CURVE COMPUTATIONS Final Report
Thomas E. Mitsock Sep. 1978 43 p
(AD-A060872; ARSEC-78-5) Avail: NTIS HC A03/MF A01 CSCL 01/3

This report describes the usage of an interactive FORTRAN computer program written for use on a CDC 6500/6600 computer to perform regression of data onto unit learning curves and estimation of costs from unit learning curves. No prior computer experience is necessary to run this program as all data prompts are English language questions and all data entries are free format. A source code listing of this program can be obtained from the performing organization. Minor I/O modifications may be necessary for other than CDC computer systems.
Author (GRA)

N79-15008# Boeing Vertol Co., Philadelphia, Pa.
INTERACTIONAL AERODYNAMICS OF THE SINGLE-ROTOR HELICOPTER CONFIGURATION, VOLUME 1 Final Report, 15 Mar. 1977 - 13 Feb. 1978
Philip F. Sheridan Sep. 1978 304 p refs
(Contract DAAJ02-77-C-0020; DA Proj. 1L2-62209-AH-76)
(AD-A060389; USARTL-TR-78-23A-Vol-1) Avail: NTIS HC A14/MF A01 CSCL 01/3

A study has been conducted to understand the interactional aerodynamics problems occurring during the UTTAS development. Powered wind tunnel model data were organized and analyzed in the following categories of interactions: Rotor/ground; Rotor/fuselage; Rotor/fuselage/ground; Rotor/empennage; and Rotor/empennage/ground. The following related problem areas are considered: severe lateral trim changes during transition close to the ground; the occurrence of high vibratory aerodynamic loads on the airframe surfaces; turbulent flow on the airframe near the ground; excessive low-frequency unsteady loads on the empennage in forward flight due to the hub/rotor wake; and poor efficiency in tail rotor installations due to adverse fin loading. GRA

N79-15009# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
BOUNDARY LAYER FENCE METHOD FOR MEASURING SURFACE SHEAR STRESS IN A SUPERSONIC HIGH REYNOLDS NUMBER FLOW FIELD Interim Report, Oct. 1977 - Apr. 1978
Anthony W. Fiore and Norman E. Scraggs Aug. 1978 48 p refs
(AF Proj. 2307)
(AD-A060600; AFFDL-TR-78-89) Avail: NTIS HC A03/MF A01 CSCL 20/4

Experimental research on a boundary layer fence technique was conducted in the Air Force Flight Dynamics Laboratory's M-3 high Reynolds number wind tunnel. The purpose of the research was to develop this particular technique for measuring the surface shear stress in a supersonic compressible turbulent boundary with near adiabatic wall condition and zero pressure gradient. The measurements were made on the tunnel wall at a nominal Mach number of three. The Reynolds number was changed by two methods, i.e., changing the tunnel stagnation pressure and the measuring station. The resulting momentum thickness Reynolds number varied from 20,000 to approximately 540,000. The recorded measurements were (1) the surface shear stress, (2) the Preston pressures, and (3) the pressures ahead and behind the boundary layer fence. The corresponding skin friction coefficients were compared with each other and the Van Driest 2 theory. The skin friction coefficients obtained with the fence agreed reasonably well with those obtained with a balance and the Preston tube. The skin friction coefficients from all three techniques agreed very well with the Van Driest 2 theory. Author (GRA)

N79-15010# Boeing Commercial Airplane Co., Seattle, Wash.
NONLINEAR INTERACTION BETWEEN MEAN AND UNSTEADY FLOWFIELDS NEAR MACH 1
Wilson C. Chin 1978 29 p refs
(Contract N00014-78-C-0349)
(AD-A060789) Avail: NTIS HC A03/MF A01 CSCL 20/4

The nonlinear interaction between a steady transonic mean flow and that induced by superposed small-amplitude oscillations is studied using the method of harmonic expansions. A truncated system of spectral equations is derived which accounts for both freqeuncy and amplitude dependent changes to the mean flow, as would be induced by Reynolds stress feedback, and in particular, that owing to the primary harmonics. A three level mixed differencing scheme, comservative to leading order, is devised to solve for the nonlinearly coupled mean and unsteady disturbance flows. The harmonic method presented here is not as computationally efficient as existing ADI methods, for example, the recent scheme of Ballhaus and Goorjian, but it does yield some insight into the governing dynamical processes, and it may be useful in nonlinear flutter analyses. GRA

N79-15011# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
A STUDY OF TURBULENT FLOWS ABOUT OSCILLATING AIRFOILS Final Report, 1 Jun. 1975 - 31 Aug. 1978
J. C. Wu Sep. 1978 10 p
(Grant DAAG29-75-G-0147)
(AD-A060491; ARO-13100.2-E) Avail: NTIS HC A02/MF A01 CSCL 20/4

A two-equation differential model of turbulence has been studied in detail and used in conjunction with an integro-differential approach for the numerical solution of separated flow problems. A number of turbulent flow problems have been solved numerically and the results obtained have been compared with available experimental data. The most significant result of this research is that a versatile and highly efficient approach has been made available for numerically solving complex turbulent flow problems. The cornerstone of this research project is the integro-differential approach developed by the principal investigator and his co-workers. Author (GRA)

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N79-15012# Civil Aeromedical Inst., Oklahoma City, Okla.
AGRICULTURAL AVIATION VERSUS OTHER GENERAL AVIATION: TOXICOLOGICAL FINDINGS IN FATAL ACCIDENTS
Delbert J. Lacefield, Patricia A. Roberts, and Curtis W. Blossom Sep. 1978 7 p refs
(AD-A060110; FAA-AM-78-31) Avail: NTIS HC A02/MF A01 CSCL 06/20

Results from the toxicological study of samples from 174 pilots killed while engaged in aerial application and samples from 2,449 other general aviation pilots are compared. The incidence of alcohol in specimens was similar for ag pilots and other general aviation pilots but the blood levels of alcohol tended to be lower in the ag pilots. Carbon monoxide as an incapacitating agent did not appear to be a factor in aerial application operations. Evidence of the use of drugs or medications was less in ag pilots than in other general aviation pilots. Over half of the ag pilots had below normal cholinesterase levels, suggesting a continuing problem of acute and/or chronic toxicity from the pesticides being applied by agricultural aircraft. This finding suggests that better educational efforts could reduce the accident rate in this important segment of our agricultural activity. , Author

N79-15013*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AIRCRAFT CABIN OZONE MEASUREMENTS ON B747-100 AND B747-SP AIRCRAFT: CORRELATIONS WITH ATMOSPHERIC OZONE AND OZONE ENCOUNTER STATISTICS
Porter J. Perkins, J. D. Holdeman, and Daniel J. Gauntner Jan. 1978 41 p refs Presented at a Tech. Briefing on Ozone, Cleveland, Ohio, 19 Jan. 1978
(NASA-TM-79060; E-9875) Avail: NTIS HC A03/MF A01 CSCL 06F

Simultaneous measurements of atmospheric (outside) ozone

concentration and ozone levels in the cabin of the B747-100 and B747-SP airliners were made by NASA to evaluate the aircraft cabin ozone contamination problem. Instrumentation on these aircraft measured ozone from an outside probe and at one point in the cabin. Average ozone in the cabin of the B747-100 was 39 percent of the outside. Ozone in the cabin of the B747-SP measured 82 percent of the outside, before corrective measures. Procedures to reduce the ozone in this aircraft included changes in the cabin air circulation system, use of the high-temperature 15th stage compressor bleed, and charcoal filters in the inlet cabin air ducting, which as separate actions reduced the ozone to 58, 19 and 5 percent, respectively. The potential for the NASA instrumented B747 aircraft to encounter high levels of cabin ozone was derived from atmospheric oxone measurements on these aircraft. Encounter frequencies for two B747-100's were comparable even though the route structures were different. The B747-SP encountered high ozone than did the B747-100's.

Author

N79-15014*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

NASA AVIATION SAFETY REPORTING SYSTEM Quarterly Report, 1 Jan. - 31 Mar. 1978

Oct. 1978 60 p refs Prepared in cooperation with Battelle Columbus Labs., Mountain View, Calif.

(NASA-TM-78540; A-7662; QR-8) Avail: NTIS HC A04/MF A01 CSCL 01C

The study deals with 165 inadvertent operations on or into inappropriate portions of the aircraft areas at controlled airports. Pilot-initiated and controller-initiated incursions are described and discussed. It was found that a majority of the pilot-initiated occurrences involved operation without a clearance; controller-initiated occurrences usually involved failure to maintain assured separation. The factors associated with these occurrences are analyzed. It appears that a major problem in these occurrences is inadequate coordination among the various system participants. Reasons for this, and some possible solutions to various aspects of the problem, are discussed. A sample of reports from pilots and controllers is presented. These relate to undesired occurrences in air transport, general aviation, and air traffic control operations; to ATC coordination problems; and to a recurrent problem in ASRS reports, parachuting operations. A sample of alert bulletins and responses to them is presented. Author

N79-15015*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

EFFECT ON HEAD-WIND PROFILES AND MEAN HEAD-WIND VELOCITY ON LANDING CAPACITY FLYING CONSTANT-AIRSPEED AND CONSTANT-GROUNDSPEED APPROACHES

Earl C. Hastings, Jr. and Wendell W. Kelley Jan. 1979 47 p refs

(NASA-TM-78804) Avail: NTIS HC A03/MF A01 CSCL 01C

A study was conducted to determine the effect of head-wind profiles and mean head-wind velocities on runway landing capacity for airplanes flying constant-airspeed and constant-groundspeed approaches. It was determined that when the wind profiles were encountered with the currently used constant airspeed approach method, the landing capacity was reduced. The severity of these reductions increased as the mean head-wind value of the profile increased. When constant-groundspeed approaches were made in the same wind profiles, there were no losses in landing capacity. In an analysis of mean head winds, it was determined that in a mean head wind of 35 knots, the landing capacity using constant-airspeed approaches was 13% less than for the no wind condition. There were no reductions in landing capacity with constant-groundspeed approaches for mean head winds less than 35 knots. This same result was observed when the separation intervals between airplanes was reduced. J.A.M.

N79-15016# Boeing Aerospace Co., Seattle, Wash.

CREW ESCAPE CONCEPTS FOR ADVANCED HIGH PERFORMANCE AIRCRAFT Final Technical Report, 1 Sep. 1977 - 1 Mar. 1978

Douglas E. Swanson Aug. 1978 177 p refs

(Contract F33615-77-C-2056; AF Proj. 2402)

(AD-A060519; D180-24086-1) Avail: NTIS HC A09/MF A01 CSCL 06/7

An investigation into the critical environments associated with escape from a high performance aircraft led to the evaluation of new crew escape concepts. Five of these concepts were compared in terms of their escape capability, cost, reliability, maintainability, development risk and impact on search and rescue operations. Following this comparison, three concepts were selected as having a potential for meeting all requirements. One concept utilizes a separable nose section for high speed or high altitude escape. Normal ejection occurs following deceleration or reduction in altitude. This concept is highly airplane configuration sensitive. The other two concepts are (1) an optional upward or downward ejection dependent upon the acceleration environment. The system is shielded by means of an extended wedge and stabilized by means of reaction jets; and (2) retained windshield/aftbody streamline. This system provides q protection through attachment of the windshield to the escape seat and a streamline aftbody for stability. Author (GRA)

N79-15017# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems Logistics.

FORMULATION OF A MODEL TO PREDICT SECOND DESTINATION TRANSPORTATION TONNAGE ESTIMATES FOR FUTURE BUDGET REQUIREMENTS M.S. Thesis

Christopher J. Lamb and Joseph B. Sarnacki Sep. 1978 90 p refs

(AD-A060490; AFIT-LSSR-21-78B) Avail: NTIS HC A05/MF A01 CSCL 05/1

The purpose of the research was to develop a better method for computing SDT tonnage estimates which are used to derive future budget requirements. The objectives were to determine whether flying hours, manpower, or both were significantly reliable predictors of tonnage estimates and to develop a computerized model for computation of SDT tonnage and budget estimates. Obtaining both actual and programmed data with MAC as a data source, discontinuous linear regression was used to derive twelve equations for the five overseas geographic areas serviced by MAC. The equations were synthesized into four models which were tested by various statistical methods to determine their overall validity. The optimal model chosen verified that programmed flying hours and manpower were significantly reliable predictors of tonnage estimates. A comparison between the optimal model and the method currently used to estimate tonnage revealed that the model provided a significantly more accurate estimation of tonnage to be moved. Computerization of the model was developed utilizing FORTRAN and the Statistical Package for the Social Sciences. After reviewing the results, the authors concluded that tonnage can be estimated using programmed flying hours and manpower as variables to derive future SDT budget requirements. Author (GRA)

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications.*

N79-15018# Army Research Inst. for the Behavioral and Social Sciences, Alexandria, Va.

EVALUATION OF A MAP INTERPRETATION AND TERRAIN ANALYSIS COURSE FOR NAP-OF-THE-EARTH NAVIGATION

Garvin L. Holman Aug. 1978 48 p refs

(DA Proj. 2Q7-63743-A-772)

(AD-A060565; ARI-RR-1198) Avail: NTIS HC A03/MF A01 CSCL 17/7

This report documents the training effectiveness of a map interpretation and terrain analysis course (MITAC) developed by the Army Research Institute to enhance nap-of-the-earth (NOE) navigation skills. A two-group transfer-of-training study showed that MITAC-trained student aviators could navigate along NOE routes at twice the speed and with one-third the errors of normally

trained student aviators. Interviews with experienced NOE aviators exposed to the MITAC material indicated that their navigation skills and understanding of student problems were also increased. It has been recommended that all Army aviators with NOE flight requirements be given MITAC training. Author (GRA)

N79-15019# Army Research Inst. for the Behavioral and Social Sciences, Alexandria, Va.
EFFECTIVENESS OF A MAP INTERPRETATION AND TERRAIN ANALYSIS COURSE ON NAP-OF-THE-EARTH NAVIGATION TRAINING OF CREWCHIEF/OBSERVERS
Garvin L. Holman Aug. 1978 36 p refs
(DA Proj. 2Q7-63743-A-772)
(AD-A060564; ARI-RR-1197) Avail: NTIS HC A03/MF A01 CSCL 17/7

This report documents the training effectiveness of a Map Interpretation and Terrain Analysis Course (MITAC) in enhancing the Nap-of-the-Earth (NOE) navigation skills of scout helicopter crewchief/observers in Europe. A two-group transfer of training study showed that MITAC trained enlisted crewchief/observers could navigate a scout helicopter while flying NOE with almost twice the speed and 35% fewer errors as untrained crewchief/observers. These data are compared with similar data from student aviators obtained in the U.S. It was concluded that MITAC could be used effectively to train crewchief/observers to navigate NOE and that MITAC could be used to train both aviators and nonaviators in Europe. Author (GRA)

N79-15020# Army Research Inst. for the Behavioral and Social Sciences, Alexandria, Va.
AN ASSESSMENT OF THE NAVIGATION PERFORMANCE OF ARMY AVIATORS UNDER NAP-OF-THE-EARTH CONDITIONS
Michael L. Fineberg, David Meister, and John P. Farrell Aug. 1978 38 p
(DA Proj. 2Q1-64715-A-757)
(AD-A060563; ARI-RR-1195) Avail: NTIS HC A03/MF A01 CSCL 17/7

The introduction of Nap-of-the-Earth (NOE) tactics presents special difficulties to Army rotary wing aviators, particularly in navigation. The extent of terrain in the navigator's field of view is greatly reduced, owing to the proximity to the ground; also, the interpretation of the terrain features depicted on an aerial map is difficult because the view is much more oblique than in normal flight. This research effort had four specific goals: (1) To determine the present level of aviation NOE performance, (2) To develop and evaluate a qualitative NOE navigation performance measure, (3) To measure the effects of additional terrain-analysis training, and (4) To measure the effects of flight experience on NOE performance. The findings from this study formulated the departure point for a thorough analysis of the NOE navigation requirements leading toward an NOE navigation instructional program for Initial Entry Rotary Wing (IERW) and operational units. GRA

N79-15021# Transportation Systems Center, Cambridge, Mass.
AN EVALUATION OF SHORE-BASED RADIO DIRECTION FINDING Final Report, Jan. 1977 - Apr. 1978
Charles J. Murphy Sep. 1978 84 p refs
(AD-A060474; TSC-USCG-78-8; USCG-D-28-78) Avail: NTIS HC A05/MF A01 CSCL 17/3

This report describes an evaluation of Radio Direction Finding (RDF) techniques for shore-based position location performed by the Transportation Systems Center (TSC). The evaluation consisted of the following three phases: (1) A preliminary survey to identify and classify available direction-finding techniques which could meet Coast Guard requirements; (2) An analytical modeling and error analysis of the equipment types identified in (1); and (3) Field testing and demonstration of representative equipment. Major system characteristics considered in the study were: (1) Operational utility of such a system; (2) Cost to implement the system throughout the USCG; (3) Operational impact on the group level - manning and maintenance; (4) Compatibility with existing land lines and VHF-FM remoting capability; (5) Operation in a VHF-FM maritime mobile band; (6) Location of the DF antenna; (7) Ability to home on both voice and EPIRB; and (8) Interference effects. GRA

N79-15022# Arinc Research Corp., Santa Ana, Calif.
SUMMARY OF INTEGRATION SUPPORT ACTIVITIES FOR NAUSTAR GPS. PHASE 2: USER EQUIPMENT Final Report, 1 Sep. 1976 - 30 Jun. 1978
G. R. Bryan Jun. 1978 17 p
(Contract F04701-76-C-0273)
(AD-A060413; Rept-1191-01-2-1765) Avail: NTIS HC A02/MF A01 CSCL 17/7

Activities performed by ARINC Research Corporation relating to the integration of NAVSTAR Global Positioning System user equipment with host vehicles are summarized. GRA

N79-15023# Aerospace Corp., El Segundo, Calif. Satellite Systems Div.
MARAD/GPS DEMONSTRATION PROJECT Final Report, Apr. 1976 - Sep. 1978
John Pitre Sep. 1978 152 p refs
(Contract F04701-77-C-0078)
(AD-A060601; TR-0079-(4818)-1; SAMSO-TR-78-129) Avail: NTIS HC A07/MF A01 CSCL 17/7

This report provides an overview of Navstar GPS operation and develops the demonstration objectives and data requirements for the at-sea demonstration of the z-set. It develops the rationale and illustrates the engineering analyses that went into the suggested z-set hardware changes and demonstration software requirements. This report also defines the z-set error sources, describes the ship simulation used to predict z-set performance, and discusses the simulation results. It includes recommendations for the demonstration configuration and identifies a potential GPS impact on marine systems of the 1980's as an area for future investigation. Author (GRA)

N79-15024# Systems Control, Inc., Palo Alto, Calif.
STUDY OF THE PERFORMANCE OF AIDS TO NAVIGATION SYSTEMS. PHASE 1, CLOSED LOOP MODEL OF THE PROCESS OF NAVIGATION Final Report, 30 Sep. 1977 - 29 Mar. 1978
W. H. Clark, A. R. Stephenson, R. H. Bateson, J. E. Jones, and C. G. Pohle Mar. 1978 519 p refs
(Contract DOT-CG-75400-A)
(AD-A059891; USCG-D-38-78) Avail: NTIS HC A22/MF A01 CSCL 17/7

The results of a study of aids-to-navigation systems in the harbor and harbor entrance environment were studied to develop a preliminary methodology to clearly identify the essential elements of the process of navigation, and to develop a preliminary analytical model to evaluate systems of aids to navigation. A survey of experts in navigation, navigation research, and NAVAID system planning was completed and the current state-of-the-art in each area was summarized. The essential elements of the process of navigation were identified and were incorporated in a functioning model of the process of navigation. This model was used to successfully emulate mariner/vessel performance in real-world conditions. The mariner's requirements for navigational information were identified and correlated with information utilization associated with unique harbor, vessel, environmental, and visual aids to navigation system characteristics. F.O.S.

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

N79-15025*# Systems Control, Inc., Palo Alto, Calif.
FLIGHT TEST DESIGN FOR CH-47 PARAMETER IDENTIFICATION
W. E. Hall, Jr. and J. Vincent Dec. 1978 203 p refs
(Contract NAS1-14010)
(NASA-CR-158948) Avail: NTIS HC A10/MF A01 CSCL 01C

The VTOL Approach and Landing Technology (VALT) program is a significant experimental research program aimed at establishing a data base for rotorcraft operation in a terminal area

environment. Work was undertaken to determine helicopter math models suitable for analyzing maneuvers along a VTOL trajectory and to apply these math models to determine the flight test procedures of greatest effectiveness in establishing helicopter dynamic characteristics in this mode of operation. As the principal result of this investigation, a flight test specification is presented for the CH-47 VALT aircraft operating along the specified VTOL trajectory of the VALT program. G.Y.

N79-15026# Technology, Inc., Dayton, Ohio.
STRUCTURAL AREA INSPECTION FREQUENCY EVALUATION (SAIFE). VOLUME 2: DESCRIPTION OF SIMULATION LOGIC Final Report
Carter J. Dinkeloo, Emerson F. Horner, and Martin S. Moran Apr. 1978 106 p refs
(Contract DOT-FA74WA-3493)
(AD-A059689; FAA-RD-78-29-Vol-2) Avail: NTIS HC A06/MF A01 CSCL 01/3

To assist in the evaluation of proposed structural inspection programs for commercial jet transport aircraft, a logic was developed to simulate structural defects, failures, and inspections. This logic was incorporated in a computer program entitled Structural Area Inspection Frequency Evaluation (SAIFE). SAIFE accounts for the following factors: (1) aircraft design analysis; (2) fatigue testing; (3) production, service, and corrosion defects; (4) probability of crack or corrosion detection; and (5) aircraft modification economics. The initial contract effort and a subsequent parametric analysis are reported. The SAIFE simulation logic, the background data for the analytical functions and decision making processes, and data for a typical simulation problem are presented. S.E.S.

N79-15027# Royal Aircraft Establishment, Farnborough (England).
INVESTIGATION INTO THE EFFECT OF RESIDUAL STRESSES ON FATIGUE STRENGTH AND MEASUREMENT OF RESIDUAL STRESS, WITH SPECIAL REFERENCE TO AIRCRAFT CONSTRUCTION
P. Schrader and W. Schuetz Aug. 1978 69 p refs Transl. into ENGLISH from Bundesmin. fuer Verteidigung. Forschungsber. der Wehrtechnik (West Germany), v. 77-23, 1977 p 1-62
(RAE-Lib-Trans-1977; BR66146) Avail: NTIS HC A04/MF A01

Three promising techniques to improve fatigue life were investigated: ring and pad stress coining, shot peening, and surface rolling. The techniques were first optimized under constant amplitude loading by systematically varying the most relevant parameter of inducing residual compressive stresses. The optimum parameter was then tested under realistic loads: a flight by flight or random sequence. Three high strength materials, Ti 6-6-2, Al-Zn MgCuAg, and a maraging steel, were tested in the form of an open hole, plane bending and a fillet specimen. Attempts were made to measure the residual stresses induced by each method using strain gauges. It was concluded that large improvements in fatigue life are possible even under realistic stresses and sequences, using shot peening, coining and surface rolling. The improvements in life cannot be explained by residual stresses alone, at least for the aluminum alloy. Finally, it is shown that even titanium alloys can be successfully coined and even a very high strength steel can be successfully surface rolled. G.G.

N79-15028# Boeing Vertol Co., Philadelphia, Pa.
CANOPY GLINT SCREENING INVESTIGATION Final Report, Aug. 1976 - Jul. 1977
Stephen J. Blewitt and David R. Gundling Sep. 1978 70 p refs
(Contract DAAJ02-76-C-0061; DA Proj. 1F2-62209-AH-76)
(AD-A060093; USARTL-TR-78-34) Avail: NTIS HC A04/MF A01 CSCL 01/3

This report presents the results of a program which investigated alternatives to flat-plate canopy concepts to control helicopter visual detection cues and to reduce internal reflections. During the program, full-scale soft mockups were constructed, tested, and evaluated. Author (GRA)

N79-15029# TRADOC Systems Analysis Activity, White Sands Missile Range, N. Mex.
FLIGHT PROFILE PERFORMANCE HANDBOOK. VOLUME 2: UH-60A (BLACKHAWK)
Nathan H. Cleek, Jr., Edward F. Smith, Jr., and Alan J. Wolfe Jun. 1978 129 p
(AD-A060055; TRASANA-TR-3-78-Vol-2) Avail: NTIS HC A07/MF A01 CSCL 01/3

The purpose for preparing this handbook series is fourfold: (1) to validate BLACKHAWK performance data quickly, (2) to reduce the manpower and time to prepare accurate flight profiles, (3) to standardize performance data so that the analysis community can benefit from a single reference in conducting studies and (4) to provide a handbook that can be used for training in the mission profile planning area. GRA

N79-15030# TRADOC Systems Analysis Activity, White Sands Missile Range, N. Mex.
FLIGHT PROFILE PERFORMANCE HANDBOOK. VOLUME 3: AH-1G (COBRA)
Nathan H. Cleek, Jr. and Alan J. Wolfe Aug. 1978 132 p
(AD-A060056; TRASANA-TR-3-78-Vol-3) Avail: NTIS HC A07/MF A01 CSCL 01/3

The purpose for preparing this handbook series is fourfold: (1) to validate AH-1G performance data quickly, (2) to reduce the manpower and time to prepare accurate flight profiles, (3) to standardize performance data so that the analysis community can benefit from a single reference in conducting studies and (4) to provide a handbook that can be used for training in the mission profile planning area. GRA

N79-15031# TRADOC Systems Analysis Activity, White Sands Missile Range, N. Mex.
FLIGHT PROFILE PERFORMANCE HANDBOOK. VOLUME 4: AH-1S (COBRA)
Nathan H. Cleek, Jr. and Alan J. Wolfe Aug. 1978 223 p
(AD-A060057; TRASANA-TR-3-78-Vol-4) Avail: NTIS HC A10/MF A01 CSCL 01/3

The purpose for preparing this handbook series is fourfold: (1) to validate AH-1S performance data quickly; (2) to reduce the manpower and time to prepare accurate flight profiles; (3) to standardize performance data so that the analysis community can benefit from a single reference in conducting studies; and (4) to provide a handbook that can be used for training in the mission profile planning area. GRA

N79-15032# TRADOC Systems Analysis Activity, White Sands Missile Range, N. Mex.
FLIGHT PROFILE PERFORMANCE HANDBOOK. VOLUME 5: YAH-64 (ADVANCED ATTACK HELICOPTER-AAH)
Nathan H. Cleek, Jr. and Alan J. Wolfe Sep. 1978 130 p
(AD-A060058; TRASANA-TR-3-78-Vol-5) Avail: NTIS HC A07/MF A01 CSCL 01/3

The purpose for preparing this handbook series is fourfold: (1) to validate YAH-64 performance data quickly; (2) to reduce the manpower and time to prepare accurate flight profiles; (3) to standardize performance data so that the analysis community can benefit from a single reference in conducting studies; and (4) to provide a handbook that can be used for training in the mission profile planning area. GRA

N79-15033# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
DEVELOPMENT OF A SYSTEMATIC TECHNIQUE FOR ANALYZING THE EFFECTIVENESS OF AIRCRAFT CLASS 4 MODIFICATIONS M.S. Thesis
Charlie J. Coleman, Jr. Sep. 1978 121 p refs
(AD-A060551; AFIT-LSSR-10-78B) Avail: NTIS HC A06/MF A01 CSCL 15/5

This study uses data from the Air Force Maintenance Requirements Data System (G098) to develop an assessment technique which uses parametric and nonparametric statistical mean difference tests to evaluate the effectiveness of Class 4 modifications. Fourteen selected modifications were evaluted to demonstrate how the G098 data were compiled and analyzed by this technique. Included in this evaluation were data on maintenance actions, manhours, NORM, NORS, and failures before and after the modification. These data sets were adjusted for variations in flying hours and sorties. The data were then analyzed

to determine if there were any significant improvements as a result of the Class 4 modification. A modification was determined to be effective if these improvements were part of the original stated purpose of the modification as indicated on the AFLC Form 48. The results of the study indicated that a systematic assessment technique which uses existing data could be developed. Author (GRA)

N79-15034# Army Aviation Engineering Flight Activity, Edwards AFB, Calif.

TS-2A AIRTANKER EVALUATION, PHASE 2 Final Report

Joseph C. Watts, Edward E. Bailes, Sherwood C. Spring, and Jerry R. Guin Mar. 1978 99 p

(AD-A060940; USAAEFA-77-07) Avail: NTIS HC A05/MF A01 CSCL 01/3

The United States Army Aviation Engineering Flight Activity performed a limited handling qualities and performance evaluation of the TS-2A airplane modified with a retardant tank system for use in the United States Forest Service airtanker mission. The evaluation was conducted in two phases: Phase 1, prior to installation of the liquid dispensing tanks, and Phase 2, following installation of the tank modification. Phase 1 was conducted in 1972 by USAAEFA. The Phase 2 evaluation was conducted from 3 October through 6 December 1977 at Edwards Air Force Base (elevation 2302 feet) and South Lake Tahoe Airport, California (elevation 6262 feet). Thirty-three flights were accomplished for a total time of 50 hours, of which 36.5 hours were productive. The tanker equipped TS-2A airplane is marginal, but satisfactory for the airtanker mission. With few exceptions, the information contained in the NATOPS flight manual as modified by the FAA supplement is correct and appropriate. Recommended changes to the NATOPS manual and FAA supplement include: (1) dynamic minimum-control airspeed of 100 knots indicated airspeed; (2) rotation airspeed of 100 knots indicated airspeed for heavy gross weight operations; (3) lift-off airspeed of 105 knots indicated airspeed for heavy gross weight operations; and (4) the inclusion of accelerate/stop data generated during this test, plus a NOTE relative to abort takeoff emergency procedures. GRA

N79-15035# National Technical Information Service, Springfield, Va.

REMOTELY PILOTED VEHICLES, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, Nov. 1975 - Nov. 1978

Guy E. Habercom, Jr. Dec. 1978 234 p Supersedes NTIS/PS-77/1143; NTIS/PS-76/1034; NTIS/PS-75/876 (NTIS/PS-78/1246/4; NTIS/PS-77/1143; NTIS/PS-76/1034; NTIS/PS-75/876) Avail: NTIS HC $28.00/MF $28.00 CSCL 01C

A bibliography containing 227 abstracts concerning operation of vehicles under remote guidance and control is presented. Aircraft, drones, and extraterrestrial explorers are among the areas researched. GRA

N79-15036# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).

AIRCRAFT ICING

Nov. 1978 136 p refs Presented at an AGARD Fluid Dyn. Panel Round-Table Discussion on Aircraft Icing, Ottawa, 30 Sep. 1977

(AGARD-AR-127; ISBN-92-835-1302-9) Avail: NTIS HC A07/MF A01

Icing of unprotected components is one of the major problems engineers are faced with during the development phase of an aircraft. The Fluid Dynamics Panel of AGARD held a round-table discussion of the fluid dynamic aspect of icing. This took place following the FDP Symposium on Unsteady Aerodynamics in Ottawa, Canada on the 30th of September, 1977. Papers are presented on the following topics: (1) recent results on icing parameters; (2) helicopter ice detection, icing severity and liquid water content measurement; (3) icing trails on the front fuselage and engine intake of helicopters at conditions simulating forward flight; (4) ice accretion and its effects on aerodynamics of unprotected aircraft components; (5) a theoretical and experimental means to predict ice accretion shapes for evaluating aircraft handling and performance characteristics; and (6) icing test facilities and techniques in Europe. For individual titles, see N79-15037 through N79-15043.

N79-15037# Messerschmitt-Boelkow-Blohm G.m.b.H., Hamburg (West Germany).

SOME RESULTS ON ICING PARAMETERS

W. Kleuters and G. Woelfer *In* AGARD Aircraft Icing Nov. 1978 18 p refs (For primary document see N79-15036 06-05) Avail: NTIS HC A07/MF A01

Meteorological icing data on forty-seven encounters in cumulus clouds over western central Europe are analyzed statistically, and compared with similar data quoted in FAR 25 Appendix C. The data for FAR 25 Appendix were obtained by the Rotating Cylinder method, a measuring device with a capacity limited to relatively low liquid content and/or low temperatures. To overcome these limitations, the liquid water content was measured in these tests by employing a liquid-nitrogen-cooled Test Rod, enabling measurements of liquid water content up to 3 g/cu m. G.Y.

N79-15038# National Research Council of Canada, Ottawa (Ontario). Div. of Mechanical Engineering.

HELICOPTER ICE DETECTION, ICING SEVERITY AND LIQUID WATER CONTENT MEASUREMENTS

J. R. Stallabrass *In* AGARD Aircraft Icing Nov. 1978 7 p refs (For primary document see N79-15036 06-05)

Avail: NTIS HC A07/MF A01

Icing detection on a helicopter presents difficulties because of the wide relative speed range from hover to maximum cruise. High detection sensitivity is necessary at any flight speed because of the high susceptability of the rotor blades to the effects of even quite small ice accretion. An icing detector is described that largely overcomes the problem of speed dependence and thus permits the determination of icing rate and cloud liquid water content with reasonable accuracy. G.Y.

N79-15039# National Gas Turbine Establishment, Pyestock (England). Engine Test Dept.

ICING TRIALS ON THE FRONT FUSELAGE AND ENGINE INTAKES OF HELICOPTERS AT CONDITIONS SIMULATING FORWARD FLIGHT

P. F. Ashwood and R. D. Swift *In* AGARD Aircraft Icing Nov. 1978 16 p refs (For primary document see N79-15036 06-05)

Avail: NTIS HC A07/MF A01

One of the large test chambers of the Altitude Test Facility at the NGTE was successfully used for full-scale trials on the front fuselage and engine intakes of the Westland Sea King and the Westland/Aerospatiale Lynx helicopters under simulated wet icing conditions. The paper describes tests made to examine the effects of air temperature, air speed, water concentration and aircraft attitude on the extent of ice accretion. The possibility of ice ingestion by the engines during melt-off was also studied using high-speed videotape recordings. Data are also presented from non-rotating tests on full-scale sections of main rotor blade made to examine the effects on accretion of bladespeed, pitch angle, air temperature and water concentration. The effects of cyclic pitch change have also been examined and typical results are presented. The paper includes general comments on the use of an altitude cell for helicopter icing investigations and the accumulation of data leading to clearance for flight in icing conditions. Author

N79-15040# Messerschmidt-Boelkow G.m.b.H., Ottobrunn (West Germany).

ICE ACCRETION AND ITS EFFECTS ON AERODYNAMICS OF UNPROTECTED AIRCRAFT COMPONENTS

Boris Laschka and Rudolf E. Jesse *In* AGARD Aircraft Icing Nov. 1978 22 p refs (For primary document see N79-15036 06-05)

Avail: NTIS HC A07/MF A01

A survey is given on theoretical and experimental methods applied to determine the ice accretion and, its effects on the respective aerodynamics on unprotected components of a modern jet transport aircraft. Together with an introductory outline of the mechanism and the basic mathematical equations and correlations ruling ice generation, the experience obtained for the European Airbus A300 is used to describe these methods.

In addition, an example for the prediction of trajectories of shedding ice particles as applied for the German jet transport aircraft VFW 614 is given. Author

N79-15041# Boeing Co., Seattle, Wash.
A THEORETICAL AND EXPERIMENTAL MEANS TO PREDICT ICE ACCRETION SHAPES FOR EVALUATING AIRCRAFT HANDLING AND PERFORMANCE CHARACTERISTICS
Ramon W. Wilder *In* AGARD Aircraft Icing Nov. 1978 20 p refs (For primary document see N79-15036 06-05)
Avail: NTIS HC A07/MF A01

To determine the need for airfoil ice protection systems and the effects of large ice shapes on airplane performance, a research program was initiated to obtain basic ice accretion and ice shedding data on typical jet transport airfoils. An empirical relationship derived from basic airfoil water catch parameters was used to correlate measured ice accretion rates with theoretical water impingement parameters. This correlation used glaze ice heights and angles measured from the plaster casts of the actual ice shapes as taken from the two swept airfoil test models. Results of this correlation show that ice accretion characteristics are dependent on airfoil shape, particularly leading edge radius, camber and angle of attack. Complex trends of the data obtained in this test program precluded a general ice accretion relationship with other airfoils. Additional testing of other airfoil shapes and angle of attack would provide for broader application of the ice cap calculation procedures developed herein. Airplane performance penalties associated with icing in terms of landing weight penalties, and when these penalties are assessed, are also discussed. Destination airport temperatures and ice shedding characteristics are shown to be significant in determining the frequency of aerodynamic penalties due to ice. Author

N79-15042# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
ICING TEST FACILITIES AND TEST TECHNIQUES IN EUROPE
Marcel Pierre and Xavier Vaucheret *In* AGARD Aircraft Icing Nov. 1978 23 p refs (For primary document see N79-15036 06-05)
Avail: NTIS HC A07/MF A01

Icing techniques performed at various test facilities in Europe are described. The locations of the facilities are given with special emphasis on the Onera Modane center for icing tests. Problems encountered in performing artificial icing tests in wind tunnels are discussed. L.S.

N79-15043# National Research Council of Canada, Ottawa (Ontario). Div. of Mechanical Engineering.
ICING TEST FACILITIES IN CANADA
T. R. Ringer *In* AGARD Aircraft Icing Nov. 1978 12 p refs (For primary document see N79-15036 06-05)
Avail: NTIS HC A07/MF A01

The icing simulation facilities for research, development and testing at the National Research Council of Canada are described. The major facilities include a low speed icing wind tunnel, a high speed variable density tunnel, a refrigerated jet engine test cell and a helicopter icing spray rig. An Appendix is included that lists reports and papers published on icing since 1935. Author

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N79-15044*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
THE LOOK-POINT AIRCRAFT COORDINATE ESTIMATOR (LACE) AND POTENTIAL APPLICATIONS
Willard W. Anderson Jan. 1979 16 p ref
(NASA-TM-78806) Avail: NTIS HC A02/MF A01 CSCL 01D

A look-point aircraft coordinate estimator (LACE) consisting of a windshield runway symbol projector, pilot input controls, microprocessor, and eye-alignment device is described. The estimator is used by a pilot to determine his aircraft's position relative to a runway or other visible terrain or target. The pilot initially superimposes and then corrects the superposition of the runway symbol over the runway during approach during periods when the runway is visible. Using the pilot's inputs the microprocessor calculates the position of the aircraft in terms of runway coordinates, then generates an approach trajectory and issues instructions to an autopilot. The microprocessor contains a model of the aircraft's dynamics and calculates a theoretical aircraft trajectory. The theoretical position of the aircraft is then used to drive the runway symbol, with the pilot's input being additive. The system thus acts as an aid in making low visibility approaches and landings when only an occasional glimpse of the runway is possible and no ground referenced landing systems are available. The system can also be used as an independent landing monitor for ground referenced landing systems. J.M.S.

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N79-15045*# AiResearch Mfg. Co., Los Angeles, Calif.
THERMAL-STRUCTURAL DESIGN STUDY OF AN AIRFRAME-INTEGRATED SCRAMJET Interim Summary Report, Jun. 1975 - Mar. 1977
J. J. Killackey, E. A. Katinsky, S. Tepper, and A. A. Vuigner Dec. 1978 126 p refs
(Contract NAS1-13984)
(NASA-CR-145368; AiResearch-77-13967) Avail: NTIS HC A07/MF A01 CSCL 21A

Design concepts are developed and evaluated for a cooled structures assembly for the Scramjet engine, for engine subsystems mass, volume, and operating requirements, and for the aircraft/engine interface. A thermal protection system was defined that makes it possible to attain a life of 100 hours and 1000 cycles. The coolant equivalence ratio at the Mach 10 maximum thermal loading condition is 0.6, indicating a capacity for airframe cooling. The mechanical design is feasible for manufacture using conventional materials. For the cooled structures in a six-module engine, the mass per unit capture area is 12.4 KN/sq m. The total weight of a six-module engine assembly including the fuel system is 14.73 KN. G.G.

N79-15046*# Boeing Military Airplane Development, Seattle, Wash.
A METHOD TO ESTIMATE WEIGHT AND DIMENSIONS OF LARGE AND SMALL GAS TURBINE ENGINES Final Report
E. Onat and G. W. Klees Jan. 1979 136 p refs
(Contract NAS3-21205)
(NASA-CR-159481) Avail: NTIS HC A07/MF A01 CSCL 21E

A computerized method was developed to estimate weight and envelope dimensions of large and small gas turbine engines within + or - 5% to 10%. The method is based on correlations of component weight and design features of 29 data base engines. Rotating components were estimated by a preliminary design procedure which is sensitive to blade geometry, operating conditions, material properties, shaft speed, hub tip ratio, etc. The development and justification of the method selected, and the various methods of analysis are discussed. B.B.

N79-15047*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE ADVANCED LOW-EMISSIONS CATALYTIC-COMBUSTER PROGRAM. PHASE 1: DESCRIPTION AND STATUS

Andrew J. Szaniszlo 1979 13 p refs To be presented at the 24th Ann. Intern. Gas Turbine Conf. and 1st Solar Energy Conf., San Diego, Calif., 11-15 Mar. 1979; sponsored by the Am. Soc. of Mech. Engr.
(NASA-TM-79049; E-9853) Avail: NTIS HC A02/MF A01 CSCL 21E

An overview of the ongoing program is presented. Objectives, plan, schedule, pollution and performance goals, catalyst advantages, present problems, and the present status of identified combustor concepts are discussed. The possible increase in upper atmosphere oxides of nitrogen (NOx) levels due to aircraft number density increases was predicted to adversely decrease ozone concentration levels. A technique for achieving low NOx emission levels was experimentally demonstrated with a lean, premixing prevaporizing flame-tube combustor. B.B.

N79-15048*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NASA THERMAL BARRIER COATINGS: SUMMARY AND UPDATE
Francis S. Stepka 1978 23 p refs Presented at Proj. SQUID (ONR) Workshop on Cooling Problems in Aircraft Gas Turbines, Monterey, Calif., 27-28 Sep. 1978; sponsored by AFOSR, Naval Air Systems Command, and ONR
(NASA-TM-79053; E-9862) Avail: NTIS HC A02/MF A01 CSCL 21E

A durable, two-layer, plasma-sprayed coating consisting of a ceramic layer over a metallic layer was developed that has the potential of insulating hot engine parts and thereby reducing metal temperatures and coolant flow requirements and/or permitting use of less costly and complex cooling configurations and materials. The results are summarized of analytical and experimental investigations of the coatings on flat metal specimens, turbine vanes and blades, and combustor liners. Discussed are results of investigations to determine coating adherence and durability, coating thermal, strength and fatigue properties, and chemical reactions of the coating with oxides and sulfates. Also presented are the effect of the coating on aerodynamic performance of a turbine vane, measured vane and combustor liner temperatures with and without the coating, and predicted turbine metal temperatures and coolant flow reductions potentially possible with the coating. Included also are summaries of some current research related to the coating and potential applications for the coating. Author

N79-15049*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF FORWARD VELOCITY AND CROSSWIND ON THE REVERSE-THRUST PERFORMANCE OF A VARIABLE-PITCH FAN ENGINE
D. C. Reemsnyder and D. A. Sagerser 17 Jan. 1979 21 p refs Presented at the 17th Aerospace Sci. Meeting, New Orleans, 15-17 Jan. 1979; sponsored by Am. Inst. of Aeron. and Astronautics
(NASA-TM-79059; E-9873; AIAA-79-0105) Avail: NTIS HC A02/MF A01 CSCL 21E

A full-size variable-pitch fan engine was tested in the Ames 40 by 80 foot wind tunnel to determine the effect of forward velocity and crosswind on reverse-thrust performance. Two flight-type inlet configurations were tested, and a flared fan nozzle was installed as an inlet for reverse-thrust operation. Steady-state reverse-thrust performance was obtained up to 54 m/s (105 knots). An abrupt decrease in reverse thrust occurred at about 30 m/s (60 knots). Reverse thrust was established following forward-to-reverse thrust transients both statically and with forward velocities only up to 30 m/s. Author

N79-15050*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE NASA HIGH PRESSURE FACILITY AND TURBINE TEST RIG
Francis S. Stepka 1978 17 p refs Presented at the Project SQUID (ONR) Workshop on Cooling Probl. in Aircraft Gas Turbines, Monterey, Calif., 27-28 September 1978; sponsored by AFOSR, Naval Air Systems Command, and ONR
(NASA-TM-79054; E-9863) Avail: NTIS HC A02/MF A01 CSCL 21E

A description of the facility and turbine test rig is presented. Also discussed is the turbine cooling test program. L.S.

N79-15051*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRELIMINARY QCGAT PROGRAM TEST RESULTS
R. W. Koenig and G. K. Sievers 1979 19 p refs To be presented at the Business Aircraft Meeting, Wichita, Kas., 3-6 Apr. 1979; sponsored by SAE
(NASA-TM-79013; E-9802) Avail: NTIS HC A02/MF A01 CSCL 21E

NASA Lewis Research Center is conducting a program to demonstrate that large commercial engine technology can be applied to general aviation engines to reduce noise, emissions and fuel consumption and to develop new technology where required. The overall engine program, design, and technology incorporated into the QCGAT engines are described. In addition, preliminary engine test results are presented and compared to the technical requirements the engines were designed to meet. S.E.S.

N79-15052*# Teledyne Continental Motors, Mobile, Ala.
COMPUTER SIMULATION OF AN AIRCRAFT ENGINE FUEL INJECTION SYSTEM Final Report
David D. Hester Jun. 1978 93 p refs
(Contracts NAS3-19755; DOT-FA74NA-1091)
(NASA-CR-157641; AD-A060452; FAA-NA-78-156; FAA-RD-78-67) Avail: NTIS HC A05/MF A01 CSCL 21/7

An analytical model of the Teledyne Continental fuel system was studied to provide a basis for quantitatively exploring deficiencies in the system response which lead to poor exhaust emission characteristics. A computer model of the fuel system was developed based on component testing and found to give accurate predictions for pressures and flow rates within the system. The model was used to investigate modifications to the system for improved fuel management and reduced exhaust emissions. The effect of improved fuel management on engine exhaust emissions is evaluated. F.O.S.

N79-15053*# General Electric Co., Evendale, Ohio. Aircraft Engine Business Group.
ANALYSIS AND PRELIMINARY DESIGN OF AN OPTICAL DIGITAL TIP CLEARANCE SENSOR FOR PROPULSION CONTROL
G. L. Poppel Sep. 1978 28 p
(Contract NAS3-21006)
(NASA-CR-159434; R78AEG518) Avail: NTIS HC A03/MF A01 CSCL 21E

Following the generation of several concepts for passive, digital compatible, optical sensors for propulsion control systems, a tip clearance sensor was chosen for further analysis and preliminary design. Emphasis was placed on application to the TF34 engine compressor section. Laboratory experiments were performed to investigate several optical aspects of the concept. Preliminary design included an assessment of all sensor elements and recommendations for development programs. Quantitative predictions were made of sensor performance. A test plan was written to demonstrate sensor feasibility and that the performance goals can be met. A continuing experimental and design effort was suggested. Author

N79-15054# Scott Environmental Technology, Inc., Plumsteadville, Pa.
J57-59W ENGINE EMISSION TEST REPORT Final Report, Nov. 1976 - Dec. 1977
Anthony F. Souza and Harold A. Scott, Jr. Tyndall AFB, Fla. Civil and Environmental Engineering Development Office Jul. 1978 92 p
(Contract F08635-77-C-0216)
(AD-A060842; SET-1628-02-1177; CEEDO-TR-78-37) Avail: NTIS HC A05/MF A01 CSCL 21/5

The exhaust emissions from three J57-59W water injected turbojet engines were measured. Emission rates of hydrocarbons, carbon monoxide and oxides of nitrogen were calculated. Smoke opacity and particulate loading were also measured. Best estimate emission factors are presented. Author (GRA)

N79-15055# Rockwell International Corp., Columbus, Ohio. Aircraft Div.
VISCID/INVISCID INTERACTION ANALYSIS OF THRUST AUGMENTING EJECTORS Interim Report, 1 Jun. 1977 -

28 Feb. 1978
P. M. Bevilaqua and A. D. DeJoode 28 Feb. 1978 55 p refs
(Contract N00014-77-C-0271; RF41411801)
(AD-A059546; NR78H-21; ONR-CR212-249-1) Avail: NTIS HC A04/MF A01 CSCL 21/5

A method has been developed for calculating the static performance of thrust augmenting ejectors by matching a viscous solution for the flow through the ejector to an inviscid solution for the flow outside the ejector. In effect, the ejector shroud is considered to be 'flying' in the secondary velocity field induced by the entrainment of the primary jets. A two-dimensional analysis utilizing a turbulence kinetic energy model for the inner, jet mixing solution and potential flow singularities for the outer, induced flow is described. This approach offers the advantage of including external influences on the flow through the ejector. Comparisons with data are presented for an ejector having a single central nozzle and Coanda jets on the walls. The accuracy of the matched solution is found to be especially sensitive to the jet flap effect of the flow just downstream of the ejector exit. Author (GRA)

N79-15056# Environmental Protection Agency, Ann Arbor, Mich. Standards Development and Support Branch.
COST EFFECTIVENESS ANALYSIS OF THE PROPOSED REVISIONS IN THE EXHAUST EMISSION STANDARDS FOR NEW AND IN-USE GAS TURBINE AIRCRAFT ENGINES BASED ON EPA'S INDEPENDENT ESTIMATES
Richard S. Wilcox and Richard W. Munt Feb. 1978 50 p refs
(PB-286388/4; AC-78-01) Avail: NTIS HC A03/MF A01 CSCL 01C

To determine the most efficient means of achieving the national ambient air quality standards, the cost effectiveness of various pollution abatement control strategies were compared and the most effective were implemented. A cost effectiveness analysis of the proposed revisions in exhaust emission standards for aircraft gas turbine engines using EPA's independent cost estimate is presented. GRA

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N79-15057*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
COMPENSATING LINKAGE FOR MAIN ROTOR CONTROL Patent Application
Phillip A. Jeffery (Sikorsky Aircraft Div., Stratford, Conn.) and Rudolf F. Huber, inventors (to NASA) Filed 15 Dec. 1978 17 p Sponsored by NASA
(NASA-Case-LAR-11797-1; US-Patent-Appl-SN-969755) Avail: NTIS HC A02/MF A01 CSCL 01C

A helicopter rotor control system is described which will automatically compensate for unwanted signal inputs due to relative movement between an airframe structure and a rotor and transmission which is isolated from the airframe structure by a hydraulic cushion. The rotor control signal is transmitted to a summing linkage by means of a control rod. The summing linkage moves the inner rod by an amount proportional to the control signal which in turn adjusts the actuating rod by means of a bellcrank. The relative motion of transmission is passed to the outer compensating rod by a bracket. The compensating rod adjusts a summing link which moves the inner rod by an amount proportional to the relative motion of transmission. Thus, relative motion of transmission is prevented from moving the actuator rod and sending false control signals to the hydraulic actuators which change the pitch of the helicopter rotor blades. NASA

N79-15058# Princeton Univ., N. J. Flight Research Lab.
A STUDY OF LONGITUDINAL CONTROLLABILITY AND STABILITY REQUIREMENTS FOR SMALL GENERAL AVIATION AIRPLANES Final Report
David R. Ellis and Cornelius L. Griffith 3 Aug. 1978 145 p refs
(Contract DOT-FA75WA-3679)
(AD-A060467; AMS-1369; FAA-RD-78-113) Avail: NTIS HC A07/MF A01 CSCL 01/3

Several aspects of small airplane longitudinal stability and control were examined by means of analysis and in-flight simulation experiments. The influence of various levels of static stability in the context of approach, landing, and climb tasks was studied, with particular emphasis on the effects of force gradient augmentation by means of downsprings. Cases in which spring force varied with elevator deflection or with angle of attack were considered in addition to the classical constant-force type. Constant-force or increasing force with up-elevator springs were favored when the preferred natural (no device) gradient was not available. Maneuvering stability tests focused on the effects of departure from linear force vs. normal acceleration characteristics; a local reduction in slope of 50 percent was detectable but considered to be acceptable. Author

N79-15059# Rockwell International Corp., Columbus, Ohio. Aircraft Div.
FLIGHT VERIFICATION OF THE ADVANCED FLIGHT CONTROL ACTUATION SYSTEM (AFCAS) IN THE T-2C AIRCRAFT Final Report, 30 Jun. 1976 - 30 Jun. 1978
Joseph N. Demarchi and Robert K. Haning Aug. 1978 144 p refs
(Contract N62269-76-C-0201)
(AD-A060326; NR78H-36; NADC-75287-60) Avail: NTIS HC A07/MF A01 CSCL 01/3

The feasibility of the Advanced Flight Control Actuation System (AFCAS) concept was demonstrated in a T-2C aircraft. The test installation contained a localized 8000 psi (55 MPa) hydraulic power supply, control-by-wire direct-drive modular design rudder actuator, electronic drive unit, and force transducer. The system performed exceptionally well during 10.2 hours of flight evaluation. Successful completion of this project confirmed prior analyses and laboratory testing. Author (GRA)

N79-15060# ARO, Inc., Arnold Air Force Station, Tenn.
SENSITIVITY OF AIRCRAFT SPINNING MOTION TO DYNAMIC CROSS-COUPLING AND ACCELERATION DERIVATIVES Final Report, 1 Oct. 1976 - 30 Sep. 1977
R. W. Butler and T. F. Langham Oct. 1978 48 p refs
(AD-A060516; AEDC-TR-78-12) Avail: NTIS HC A03/MF A01 CSCL 01/2

An investigation was conducted to provide an insight into the importance of dynamic cross-coupling and acceleration derivatives in the spinning motion of fighter aircraft. The basic spinning motion of two aircraft was generated with a six-degree-of-freedom motion simulation program. The dynamic cross-coupling and acceleration derivatives were input into the program both individually and simultaneously to note their effect on the time history of spinning motion. Results of the study indicate that the dynamic derivatives can produce significant effects on the aircraft spinning motion and should be considered when conducting a spin analysis. The study also indicates that the spinning motion sensitivity to the dynamic cross-coupling and acceleration derivatives investigated is configuration dependent. GRA

N79-15061# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
DYNAMIC STABILITY PARAMETERS
Nov. 1978 623 p refs In ENGLISH and FRENCH Symp. held in Athens, 22-24 May 1978
(AGARD-CP-235; ISBN-92-835-0223-X) Avail: NTIS HC A99/MF A01

The mission of AGARD is to bring together the leading personalities of the NATO nations in the fields of science and technology relating to aerospace. This symposium was organized in recognition of the strong present-day interest in dynamic stability of aerospace vehicles. The purpose of the symposium was to discuss the specific needs for dynamic stability information, the form in which it should be presented and the various means of obtaining it. The symposium was divided into the following sessions: (1) wind tunnel techniques 1; (2) wind tunnel techniques 2; (3) flight testing techniques; (4) analytical techniques; (5) motion analysis and nonlinear formulations; (6)

sensitivity and simulator studies; and (7) workshop session. For individual titles, see N79-15062 through N79-15097.

N79-15062# National Aeronautical Establishment, Ottawa (Ontario). Unsteady Aerodynamics Lab.
TECHNIQUES FOR DYNAMIC STABILITY TESTING IN WIND TUNNELS
K. J. Orlik-Rueckemann *In* AGARD Dyn. Stability Parameters Nov. 1978 24 p refs (For primary document see N79-15061 06-08)
Avail: NTIS HC A99/MF A01

A systematic review is presented of the methods and techniques that are used for wind tunnel measurements of the dynamic stability parameters (derivatives) of an aircraft. The review is illustrated by numerous examples of experimental equipment available in various aerospace laboratories in Canada, France, the United Kingdom, the United States and West Germany. G.Y.

N79-15063# Institut de Mecanique des Fluides de Lille (France).
A NEW METHOD FOR TESTING FREE MODELS IN THE LABORATORY TO DETERMINE AERODYNAMIC CHARACTERISTICS [NOUVELLE TECHNIQUE D'ESSAIS SUR MAQUETTES LIBRES EN LABORATOIRE POUR LA DETERMINATION DE CARACTERISTIQUES AERODYNAMIQUES]
W. Charon and R. Verbrugge *In* AGARD Dyn. Stability Parameters Nov. 1978 26 p In FRENCH (For primary document see N79-15061 06-08)
Avail: NTIS HC A99/MF A01

A methodology relating to the study on free flight models under laboratory conditions linked with flight control was outlined. Experimental technique was put into operation in the area of work concerning the regulation of lift by rapid moving flaps on transport aircraft. Unstable aerodynamic coefficients were identified, and some of the following aspects of the testing technique were developed: (1) theory and experimental method; (2) structural analysis of test models; and (3) measure and treatment of unstable data. Transl. by B.B.

N79-15064*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
NEW NASA-AMES WIND-TUNNEL TECHNIQUES FOR STUDYING AIRPLANE SPIN AND TWO-DIMENSIONAL UNSTEADY AERODYNAMICS
Gerald N. Malcolm and Sanford S. Davis *In* AGARD Dyn. Stability Parameters Nov. 1978 12 p refs (For primary document see N79-15061 06-08)
Avail: NTIS HC A99/MF A01 CSCL 01C

Two new wind tunnel test apparatuses were developed at NASA-Ames Research Center. The first is a rotary-balance apparatus to be used in the Ames 12-Foot Pressure Tunnel for investigating the effects of Reynolds number, spin rate, and angle of attack on the aerodynamics of fighter and general aviation aircraft in a steady spin motion. The second apparatus provides capability for oscillating a large two dimensional wing (0.5 m chord, 1.35 m span) instrumented with steady and unsteady pressure transducers in the Ames 11 x 11 ft. Transonic Wind Tunnel. A complete description of both apparatuses, their capabilities, and some typical wind tunnel results are presented. G.Y.

N79-15065# British Aerospace Aircraft Group, Warton (England). Warton Div.
EXPERIMENTAL DETERMINATION OF DYNAMIC DERIVATIVES DUE TO ROLL AT BRITISH AEROSPACE, WARTON DIVISION
A. W. Matthews *In* AGARD Dyn. Stability Parameters Nov. 1978 16 p (For primary document see N79-15061 06-08)
Avail: NTIS HC A99/MF A01

Two rigs for the determination of dynamic derivatives due to roll are under development. Using the principle of continuously rolling a model in a wind tunnel about an axis parallel to the wind, they are intended to cover a test envelope up to M = 0.95, R sub e = 46,100,000/m, alpha = 90 degrees, pb/2V = 0.25. The general features of the rigs themselves, together with the instrumentation and control systems are described. The problems met during design, manufacture, calibration, commissioning and testing are also described, together with their solutions. Data from complete models is presented and compared with that compiled for similar configurations from flight testing and other wind tunnel sources. G.Y.

N79-15066# Technische Universitaet, Darmstadt (West Germany).
WIND TUNNEL TESTING OF DYNAMIC DERIVATIVES IN WEST GERMANY
X. Hafer *In* AGARD Dyn. Stability Parameters Nov. 1978 12 p refs (For primary document see N79-15061 06-08)
Avail: NTIS HC A99/MF A01

A survey of the activities of the German national working group engaged in the development of dynamic wind tunnel test installations is given. The development of four different test rigs was planned. So far, the development of three test rigs is complete. Each rig was designed to meet very specific test requirements which are discussed in detail. Test results are presented giving a comparison of systematic tests with the same model mounted on different test rigs in different wind tunnels. Some flight test results of the corresponding original plane are compared. In addition, some results of linearized flight dynamic investigations are presented to demonstrate the influence of the several dynamic derivatives on the longitudinal and lateral aircraft dynamics. G.Y.

N79-15067# Dornier-System G.m.b.H., Friedrichshafen (West Germany).
ON THE TEST PROCEDURES OF THE DERIVATIVE BALANCES USED IN WEST GERMANY
Jan VonderDecken, Eberhard Schmidt (DFVLR, Braunschweig, West Germany), and Bernd Schulze (Messerschmitt-Boelkow-Blohm G.m.b.H., Munich, West Germany) *In* AGARD Dyn. Stability Parameters Nov. 1978 17 p refs (For primary document see N79-15061 06-08)
Avail: NTIS HC A99/MF A01

The low-speed wind tunnels in West-Germany are equipped with three different test installations to measure dynamic stability derivatives on rigid models of aeroplanes and missiles: (1) a mobile oscillatory apparatus with inexorable mechanical drive; (2) a multi-degree-of-freedom forced-oscillation apparatus with electrodynamic excitation; (3) a steady-state forced-roll apparatus with hydraulic motor drive. A short description of the measuring technique and the appropriate derivative evaluation method used with each installation is given. G.Y.

N79-15068# National Aeronautical Establishment, Ottawa (Ontario). Unsteady Aerodynamics Lab.
EXPERIMENTS ON CROSS-COUPLING AND TRANSLATIONAL ACCELERATION DERIVATIVES
K. J. Orlik-Rueckemann and E. S. Hanff *In* AGARD Dyn. Stability Parameters Nov. 1978 8 p refs (For primary document see N79-15061 06-08)
Avail: NTIS HC A99/MF A01

Categories of dynamic stability problems are discussed that are of particular importance for aircraft flying at high angles of attack or at non-zero sideslip angles. These encompass the static and dynamic cross-coupling effects between the lateral and the longitudinal degrees of freedom, the strong nonlinear effects at high angles of attack, and the effects of translational acceleration. Experimental techniques developed to determine these effects are briefly described and some illustrative examples of the measured cross-coupling and acceleration derivatives are presented. G.Y.

N79-15069# National Aeronautical Establishment, Ottawa (Ontario). Unsteady Aerodynamics Lab.
A GENERALIZED TECHNIQUE FOR MEASURING CROSS-COUPLING DERIVATIVES IN WIND TUNNELS
E. S. Hanff and K. J. Orlik-Rueckemann *In* AGARD Dyn. Stability Parameters Nov. 1978 10 p refs (For primary document see N79-15061 06-08)
Avail: NTIS HC A99/MF A01

A novel generalized oscillatory wind tunnel technique for the determination of dynamic cross and cross-coupling derivatives is described. The technique was successfully used, by means of specially developed apparatuses, to obtain all moment derivatives due to pitching, yawing and rolling using the full model approach, as well as to determine C sub m alpha using a half model plunging approach. A separate three-degrees-of-freedom

dynamic calibrator, also described herein, was developed to independently verify the validity of the experimental and analytical procedures used for the determination of the derivatives. G.Y.

N79-15070# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
DETERMINING THE NONLINEARITIES OF DYNAMIC STABILITY [DETERMINATION DE NON-LINEARITES DE STABILITE DYNAMIQUE]
Xavier Vaucheret *In* AGARD Dyn. Stability Parameters Nov. 1978 14 p refs In FRENCH (For primary document see N79-15061 06-08)
Avail: NTIS HC A99/MF A01

Aside from classical theories of nonlinear mechanics, a classification of nonlinearity, based on their effects was proposed. Two concrete cases of strong nonlinear oscillations, one which contains a limited cycle, illustrate the methods developed.
Transl. by B.B.

N79-15071# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
SOME FACTORS AFFECTING THE DYNAMIC STABILITY DERIVATIVES OF A FIGHTER-TYPE MODEL
W. Staudacher, B. Laschka, B. Schulze, P. Poisson-Quinton (ONERA, Modane, France), and M. Canu (ONERA, Modane, France) *In* AGARD Dyn. Stability Parameters Nov. 1978 13 p refs (For primary document see N79-15061 06-08)
Avail: NTIS HC A99/MF A01

In the course of a Franco-German cooperation dynamic stability coefficients of a fighter-type pilot model were derived experimentally. In a first step, forced oscillation tests were carried out. The angle of attack regime investigated was alpha = 0 + 25 degrees. This first test phase concentrated on the investigation of the effects of a strakes, on the total derivatives of the configuration. Emphasis of a further second test period are put on configurational items as strakes, flap systems, tails, etc. and experimental characteristics as Reynolds number, frequency and amplitudes. G.Y.

N79-15072# Southampton Univ. (England). Dept. of Aeronautics and Astronautics.
AN EXPERIMENTAL STUDY OF THE HYPERSONIC DYNAMIC STABILITY OF PITCHING BLUNT CONICAL AND HYPERBALLISTIC SHAPES IN A SHORT RUNNING TIME FACILITY
R. A. East, A. M. S. Qasrawi, and M. Khalid *In* AGARD Dyn. Stability Parameters Nov. 1978 20 p refs (For primary document see N79-15061 06-08)
Avail: NTIS HC A99/MF A01

Experimental data are presented for the shapes in question at a Mach number of 6.85. The data was obtained using a free decaying oscillation technique using a light free piston compression facility having particularly steady flow characteristics during a running time up to 0.5 second. Details of the mode of operation of the facility and the dynamic stability apparatus are described. The effects of variations of Reynolds numbers and angles of attack up to 7.5 degree on the stability derivatives -Cm sub alpha and -(Cm sub q + Cm sub alpha) are presented. Comparison of the blunt cone data with previous experimental work and existing theoretical methods are given. Comparison is also made with the predictions of a new theoretical method. The reported experimental values of -Cm sub alpha and -(Cm sub q + Cm sub alpha) for the hyperballistic shapes highlight the gross errors which can be obtained from Newtonian based prediction methods. G.Y.

N79-15073# Bristol Univ. (England). Dept. of Aeronautical Engineering.
UNSTEADY AERODYNAMICS OF OSCILLATING CONTAINERS AND APPLICATION TO THE PROBLEM OF DYNAMIC STABILITY OF HELICOPTER UNDERSLUNG LOADS
A. Simpson and J. W. Flower *In* AGARD Dyn. Stability Parameters Nov. 1978 33 p refs (For primary document see N79-15061 06-08)
Avail: NTIS HC A99/MF A01

Loads slung beneath helicopters can develop alarming oscillations at quite low airspeeds due to aerodynamic forces, and hence severely curtail the performance of the helicopter. The investigation highlights the (sometimes overriding) importance of load movement on the aerodynamic forces for the particular case of the standard 20 x 8 x 8 foot container. Forces and moments were derived from pressure measurements on two models, inexorably oscillated in a variety of modes and at various amplitudes, with some comparison with other results from decaying oscillation investigations. Extreme nonlinearities are evident. Flow visualization techniques show complex flow situations and extreme phase lags in the separated flow patterns. A mathematical model based on the observed patterns compares well with the force and moment results. G.Y.

N79-15074# Air Force Flight Test Center, Edwards AFB, Calif.
AIR FORCE FLIGHT TEST CENTER EXPERIENCE IN THE IDENTIFICATION OF STABILITY AND CONTROL PARAMETERS FROM DYNAMIC FLIGHT TEST MANEUVERS
Paul M. Jeglum *In* AGARD Dyn. Stability Parameters Nov. 1978 5 p refs (For primary document see N79-15061 06-08)
Avail: NTIS HC A99/MF A01

Air Force Flight Test Center experience in the flight test determination of stability derivatives is generalized in terms of the attainment of known benefits, and the practical and philosophical necessity for the use of the technique are discussed. Data from recent flight test programs is used to illustrate that Stability Derivative Extraction (STABDEX) techniques result in savings of flight time, a significantly better and safer flight test program and high quality data which would otherwise be unobtainable. Concluding remarks discuss the importance of the technique for the flight testing of advanced designs. G.Y.

N79-15075*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
ESTIMATION OF AERODYNAMIC CHARACTERISTICS FROM DYNAMIC FLIGHT TEST DATA
Kenneth W. Liff *In* AGARD Dyn. Stability Parameters Nov. 1978 26 p refs (For primary document see N79-15061 06-08)
Avail: NTIS HC A99/MF A01

Significant effort was spent in estimating unknown aircraft coefficients, such as stability and control derivatives from dynamic flight maneuvers. The techniques used to estimate these coefficients are becoming increasingly complex; however, these techniques make it possible to obtain estimates of coefficients that in the past were nearly impossible to obtain. A survey of the investigations that were undertaken to obtain estimates of coefficients from dynamic flight maneuvers is presented. One method, the maximum likelihood estimation technique, is described briefly and some of the successful applications of the technique are presented. Possible techniques for analyzing responses obtained in the stall/spin regime are discussed. Recent data obtained in the stall/spin flight regime are presented along with a discussion of how some basic results can be obtained with simple analysis techniques. G.Y.

N79-15076# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
AERODYNAMIC INTERACTIONS ON THE FIGHTER CCV TEST AIRCRAFT
Robert A. Whitmoyer *In* AGARD Dyn. Stability Parameters Nov. 1978 13 p refs (For primary document see N79-15061 06-08)
Avail: NTIS HC A99/MF A01

The Fighter CCV YF-16 testbed aircraft completed an 87 flight 125 hour test program in June 1977. The aircraft achieved higher levels of direct force control that had previously been flight tested. The direct force capabilities were used to implement six unconventional control modes on the aircraft, consisting of flat-turns, decoupled normal acceleration control, independent longitudinal and lateral translations, and uncoupled elevation and azimuth aiming. The flight test program and supporting wind tunnel testing, produced a wealth of data concerning the complex aerodynamic interactions between the force and moment producers on a Control Configured Vehicle design. The interactions were prime factors in determining the viability of the unconventional control concepts investigated. G.Y.

N79-15077*# Calspan Corp., Buffalo, N. Y. Flight Sciences Dept.
IDENTIFICATION OF THE STABILITY PARAMETERS OF

AN AEROELASTIC AIRPLANE

Edmund G. Rynaski, Dominick Andrisani, II, and Norman Weingarten *In* AGARD Dyn. Stability Parameters Nov. 1978 9 p refs Sponsored in part by NASA. Langley Res. Center (For primary document see N79-15061 06-08)
(Contract F33615-73-C-3051)
Avail: NTIS HC A99/MF A01 CSCL 01C

The problem of the parameter identification of large scale dynamic systems involving a system matrix characterized by approximately 200 elements is addressed. By using phase variable transformations, a mathematical model of an aeroelastic airplane is described in a form that is amenable to partial or piecemeal acceptance of parameters estimated from flight data. A mathematical model of the U.S. Air Force Total In-Flight Simulator was computed using the FLEXSTAB digital computer program. As data became available during the progress of the flight test program, this data was processed and substituted in the mathematical model for parameters analytically obtained from the FLEXSTAB program. The results tend to show a progressive and orderly transition from an analytically defined mathematical model to one obtained from the flight tests of the actual aircraft. G.Y.

N79-15078# Boeing Commercial Airplane Co., Renton, Wash.
NONLINEAR PARAMETER IDENTIFICATION AND ITS APPLICATION TO TRANSPORT AIRCRAFT

T. J. Galbraith and T. J. Petersen *In* AGARD Dyn. Stability Parameters Nov. 1978 20 p refs (For primary document see N79-15061 06-08)
Avail: NTIS HC A99/MF A01

A nonlinear parameter identification computer program and results obtained from analyzing jet transport flight data characterized by nonlinear motion and parameters is described. The program is called NLAK for nonlinear aerodynamics and kinematics and is part of a system of computer programs for analyzing airplane dynamic response data. NLAK's formulation is based on the full six degrees-of-freedom equations of motion and up to third order polynomials for aerodynamic coefficients and thrust parameters. NLAK employs a maximum likelihood estimation algorithm which is capable of both recursive and batch processing. The flight data analyzed was low speed, below 150 knots. The analysis system is outlined and all interfaces with the NLAK program are described. The basic concepts and some of NLAK's formulation details are also described in relation to obtaining consistent estimation results, especially for the nonlinear problem. G.Y.

N79-15079# Northrop Corp., Hawthorne, Calif. Aerosciences Research Dept.
A SURVEY OF ANALYTICAL AND EXPERIMENTAL TECHNIQUES TO PREDICT AIRCRAFT DYNAMIC CHARACTERISTICS AT HIGH ANGLES OF ATTACK

A. M. Skow and A. Titiriga, Jr. *In* AGARD Dyn. Stability Parameters Nov. 1978 37 p refs (For primary document see N79-15061 06-08)
Avail: NTIS HC A99/MF A01

A survey of some of the techniques that will aid the fighter aircraft designer in building good high angle-of-attack aerodynamic characteristics into the airframe is presented. Some of the more well known analytical and experimental methods and endeavors to highlight the contributions each method provides are summarized. G.Y.

N79-15080# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
PRESENTATION OF STABILITY DERIVATIVES IN MISSILE AERODYNAMICS AND THEORETICAL METHODS FOR THEIR PREDICTION

C. P. Schneider *In* AGARD Dyn. Stability Parameters Nov. 1978 31 p refs (For primary document see N79-15061 06-08)
Avail: NTIS HC A99/MF A01

Analytical procedures are indicated for the determination of pitching derivatives and coefficients essentially of arbitrary planform wings, of bodies of revolution, and of combinations in the linear and nonlinear angle-of-attack range in subsonic and supersonic flow. A frame of classification of theory for missile design in particular is prepared due to the abundance of unsteady flow problems. The methods for the prediction of pitching derivatives and for solving stability problems arising with longitudinal acceleration of missile are described. Results indicate the importance of derivatives with respect to missile stability. S.E.S.

N79-15081# National Aerospace Lab., Amsterdam (Netherlands).
THE USE OF PANEL METHODS FOR STABILITY DERIVATIVES

R. Roos *In* AGARD Dyn. Stability Parameters Nov. 1978 11 p refs (For primary document see N79-15061 06-08)
Avail: NTIS HC A99/MF A01

The possibilities of panel methods for computing aerodynamic stability derivatives are reviewed. Reasons were given why not all derivatives, especially those which are dominated by viscous drag, can be computed with the same level of accuracy. The unsteady panel methods, developed for aeroelastic applications, were shown to be very useful for computing dynamic stability derivatives. The value of such methods was demonstrated with the aid of some computed examples compared with experimental data. S.E.S.

N79-15082# Waterloo Univ. (Ontario). Dept. of Applied Mathematics.
AN ANALYTIC THEORY OF SUPERSONIC/HYPERSONIC STABILITY AT HIGH ANGLES OF ATTACK

W. H. Hui *In* AGARD Dyn. Stability Parameters Nov. 1978 9 p refs (For primary document see N79-15061 06-08)
Avail: NTIS HC A99/MF A01

The problem of dynamic stability is studied based on inviscid flow theory. The amplitude and frequency of the pitching oscillation are assumed small and a perturbation method employed. Systematic investigations of the closed form analytic formulae for the stability derivatives of oscillating wedges, flat plates, delta wings (with attached shock waves or detached shock waves) lead to the following general conclusions: (1) increasing flight Mach number M sub infinity tends to increase the dynamic stability and the stability derivatives tend to constant for large M sub infinity; (2) the sweep-back angle of a delta wing has only small effects on its dynamic stability; (3) for small angles of attack alpha the damping-in-pitch derivative increases with alpha but after alpha reaches certain critical angle the trend is reversed and further increase in alpha may rapidly cause dynamical instability; and (4) the effects of the specific heat ratio gamma of the gas on dynamical stability are small for small angles of attack alpha, but are large for large alpha, and in the latter case increasing gamma can also cause dynamic instability.S.E.S.

N79-15083# Adjutant General Center, Washington, D. C.
IDENTIFICATION OF UNSTEADY EFFECTS IN LIFT BUILDUP

P. Mereau, R. Hirsch, G. Coulon, and A. Rault *In* AGARD Dyn. Stability Parameters Nov. 1978 14 p refs (For primary document see N79-15061 06-08)
Avail: NTIS HC A99/MF A01

A methodology to identify unsteady aerodynamic forces from flight test data is proposed and developed in the case of uncoupled longitudinal motion. This method includes several steps based upon linearity and frequency separation: data filtering, classical stability and control parameters identification, transient forces estimation, unsteady terms identification. The mathematical model includes state equations and convolution integrals, thus requiring particular identification algorithms, well adapted to each form of representation. The results obtained in the case of non-powered flights of a reduced scale plane are very satisfactory in the sense that their comparison with existing theoretical developments are very close and thus validate the theoretical characterizations. S.E.S.

N79-15084*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
EFFECT OF FLOW SEPARATION VORTICES ON AIRCRAFT UNSTEADY AERODYNAMICS

L. E. Ericsson and J. P. Reding *In* AGARD Dyn. Stability Parameters Nov. 1978 12 p refs (For primary document see N79-15061 06-08)
(Contracts NAS8-28130; NAS8-30652; NAS9-11445)
Avail: NTIS HC A99/MF A01 CSCL 01C

The unsteady aerodynamic flow field over the space shuttle

orbiter was studied. The results indicate at moderate to high angles of attack separation-induced vortices exact a dominating influence on the unsteady aerodynamics of the space shuttle orbiter and of high performance aircraft. The main characteristics are as follows: (1) The vortex-induced aerodynamic loads are large and highly nonlinear, sometimes discontinuous in character; and (2) the vortex-induced loads have opposite effects on static and dynamic stability characteristics. Analytic approximations are presented which can predict these vortex-induced aerodynamic effects with the accuracy needed for most engineering design. S.E.S.

N79-15085# California Inst. of Tech., Pasadena.
OSCILLATORY AERODYNAMICS AND STABILITY DERIVATIVES FOR AIRFOIL SPOILER MOTIONS
R. Bernier and G. V. Parkinson *In* AGARD Dyn. Stability Parameters Nov. 1978 7 p refs Prepared in cooperation with British Columbia Univ., Vancouver (For primary document see N79-15061 06-08)
Avail: NTIS HC A99/MF A01

An extension of a previously developed linearized incompressible potential flow theory is used in the lift, pitching moment, and spoiler hinge moment for a thin airfoil section with an upper-surface spoiler oscillating about a mean erection angle. Integral transforms, the transient lift and moment following spoiler erection are calculated. Results indicate that either the oscillatory or the transient loadings can be related to the conventional stability derivatives for spoiler displacement and rate. The oscillatory loadings produce frequency-dependent functions for the stability derivatives, while the transient loadings lead to a conventional constant displacement derivatives, but a time-dependent function for the rate derivative. S.E.S.

N79-15086*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE ROLE OF TIME-HISTORY EFFECTS IN THE FORMULATION OF THE AERODYNAMICS OF AIRCRAFT DYNAMICS
Murray Tobak and Lewis B. Schiff *In* AGARD Dyn. Stability Parameters Nov. 1978 10 p refs (For primary document see N79-15061 06-08)
Avail: NTIS HC A99/MF A01

The scope of any aerodynamic formulation proposing to embrace a range of possible maneuvers is shown to be determined principally by the extent to which the aerodynamic indicial response is allowed to depend on the past motion. Starting from the linearized formulation, in which the indicial response is independent of the past motion, two successively more comprehensive statements about the dependence on the past motion are assigned to the indicial response (1) dependence only on the recent past and (2) dependence additionally on a characteristic feature of the distant past. The first enables the rational introduction of nonlinear effects and accommodates a description of the rate-dependent aerodynamic phenomena characteristic of airfoils in low-speed dynamic stall; the second permits a description of the double-valued aerodynamic behavior characteristic of certain kinds of aircraft stall. An aerodynamic formulation based on the second statement, automatically embracing the first, may be sufficiently comprehensive to include a large part of the aircraft's possible maneuvers. The results suggest a favorable conclusion regarding the role of dynamic stability experiments in flight dynamics studies. Author

N79-15087# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.
MATHEMATICAL MODELS OF AIRCRAFT DYNAMICS FOR EXTREME FLIGHT CONDITIONS (THEORY AND EXPERIMENT)
H. H. B. M. Thomas and Geraldine Edwards *In* AGARD Dyn. Stability Parameters Nov. 1978 52 p refs (For primary document see N79-15061 06-08)
Avail: NTIS HC A99/MF A01

The basic features of various formulations of the aerodynamic forces and moments acting on an aircraft are examined. Results from mathematical models of an aircraft indicates that motions, such as spin entry, pose new problems. These relate to the question of which contributions to the aerodynamic forces and moments may be linearized and which have to be included within a term, which is a function of some of the state variables. The essential overall validation that tests using free-flight models can provide is discussed. A related wind tunnel test program, which can provide validation, is outlined. The sensitivity of the motion to changes is examined. S.E.S.

N79-15088# Kansas Univ., Lawrence. Dept. of Aerospace Engineering.
LINEAR OR NON-LINEAR ANALYSIS METHODS: WHEN AND HOW
Jan Roskam *In* AGARD Dyn. Stability Parameters Nov. 1978 17 p refs (For primary document see N79-15061 06-08)
Avail: NTIS HC A99/MF A01

The direct method of Lyapunov is used to predict under motion disturbances. Examples that large differences can exist between roll and heading responses predicted from conventional linear methods and from 'complete' non-linear methods are presented. The causes of this nonlinear behavior are identified and a simple three-step criterion for its early detection is suggested. An energy based criterion for determining the stability behavior is suggested. Examples of energy-time-histories that identify specific stability derivatives which can be major causes of non-linear behavior are shown. The relative importance of the conventional stability derivatives and of specific non-linear dynamic terms in the equations of motion in inducing non-linear behavior is discussed. S.E.S.

N79-15089# Northrop Corp., Hawthorne, Calif. Aircraft Group.
AIRCRAFT STABILITY CHARACTERISTICS AT HIGH ANGLES OF ATTACK
Juri Kalviste *In* AGARD Dyn. Stability Parameters Nov. 1978 18 p refs (For primary document see N79-15061 06-08)
Avail: NTIS HC A99/MF A01

An analysis technique where six-degree-of-freedom equations are partitioned into rotational and translational equations of motion retaining all the cross coupling between the longitudinal and lateral directional modes of motion is reported. The aircraft stability is characterized in terms of aircraft rotational motion due to static aerodynamic coefficients. A new dynamic stability axes system is defined. Stability parameters are defined about the dynamic stability axes system. A new set of stability criteria is defined in terms of the new dynamic stability derivatives. The analysis takes into account nonlinear aerodynamics and nonzero moments at zero sideslip condition. The definition of the Lateral Control Departure Parameter (LCDP) is extended for nonlinear aerodynamics and defined in terms of angle of attack and sideslip. The new criteria was validated with complete six-degree-of-freedom perturbation equation stability analysis, nonlinear time history simulation, and flight test results. S.E.S.

N79-15090# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
NON-LINEAR FORMULATION OF THE AERODYNAMIC FORCES FOR FLIGHT DYNAMIC STUDIES
Michel Scherer *In* AGARD Dyn. Stability Parameters Nov. 1978 24 p refs In FRENCH; ENGLISH summary (For primary document see N79-15061 06-08)
Avail: NTIS HC A99/MF A01

The information on the nonlinear domain involved in flight at high angle of attack is studied. Adequate aerodynamic data for the application of nonlinear analysis methods are discussed. Examples of formulation proposed by various authors in flight dynamics studies are presented. S.E.S.

N79-15091# Royal Aircraft Establishment, Bedford (England). Structures Dept.
NONLINEAR OSCILLATIONS AT HIGH INCIDENCE
G. D. Padfield *In* AGARD Dyn. Stability Parameters Nov. 1978 16 p refs (For primary document see N79-15061 06-08)
Avail: NTIS HC A99/MF A01

Approximations were developed for free aircraft motion when nonlinear effects are present and when the aircraft is flying close to a stability boundary. The analysis is based on the behavior of the isolated critical mode. The method of multiple scales is used to predict the transient oscillatory growth to a limit cycle condition. Results for the lateral motion of slender aircraft with nonlinear aerodynamic moments have revealed that limit cycles are possible

above and below the critical incidence. Aircraft motions can be stable when the linear theory predicts instability and unstable when stability is predicted. Within the framework of the perturbation analysis it is shown how damping moments may be synthesized from response measurements. S.E.S.

N79-15092# Royal Military Coll. of Science, Shrivenham (England). Dept. of Mathematics and Ballistics.
THE DYNAMIC STABILITY IN FLIGHT OF SPINNING BLUNT BODY PROJECTILES
P. C. Parks *In* AGARD Dyn. Stability Parameters Nov. 1978 8 p ref (For primary document see N79-15061 06-08)
Avail: NTIS HC A99/MF A01

Precessional motions of spinning blunt projectiles with highly non-linear pitching moment characteristics were analyzed. The precessional motion for a particular cylindrical projectile was investigated. A solution is proposed involving an optimum rounding of the leading edge of the projectile: this alters the pitching moment characteristics and also reduces drag. The precessional motion in pitch and yaw about the flight path of the projectile was examined. Proposals for improving their performance in flight by rounding the leading edge were made. S.E.S.

N79-15093*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
RESULTS OF PILOTED SIMULATOR STUDIES OF FIGHTER AIRCRAFT AT HIGH ANGLES OF ATTACK
Joseph R. Chambers, William R. Gilbert, and Luat T. Nguyen *In* AGARD Dyn. Stability Parameters Nov. 1978 13 p refs (For primary document see N79-15061 06-08)
Avail: NTIS HC A99/MF A01

The experience gained at the NASA Langley Research Center during the application of simulator techniques to high angle of attack flight conditions for several current fighters is discussed. The discussion includes (1) the simulator hardware, (2) requirements for static and dynamic aerodynamic data inputs, (3) evaluation procedures, (4) correlation with flight, and (5) the effects of dynamic stability parameters. Results obtained with the simulator technique have correlated well with flight test experience, resulting in early identification of potential problems, identification of critical flight conditions, and solutions to various deficiencies in stability and control characteristics. Dynamic stability parameters, results indicate that certain parameters can have a large influence on the flying qualities and tactical effectiveness of fighters at high angles of attack. S.E.S.

N79-15094# Sandia Labs., Albuquerque, N. Mex.
SENSITIVITY OF AIRCRAFT MOTION TO AERODYNAMIC CROSS-COUPLING AT HIGH ANGLES OF ATTACK
W. H. Curry and K. J. Orlik-Rueckemann *In* AGARD Dyn. Stability Parameters Nov. 1978 18 p refs Prepared in cooperation with National Aeronautical Establishment, Ottawa Sponsored in part by DOE (For primary document see N79-15061 06-08)
Avail: NTIS HC A99/MF A01

The equation of motion was examined using a six-degree-of-freedom simulation on a hybrid computer. Both straight and turning flight conditions were included, and to simplify the problem, the equations were formulated for the constant-thrust, stick-fixed condition. The aerodynamic cross-coupling derivatives were considered both as constants and as locally linearized functions of angle of attack. The effects of varying certain derivatives from an assumed nominal set on the response of the aircraft to an initial perturbance are presented graphically. Results indicate that the dynamic cross-coupling moment derivatives due to pitching have a marked effect, while those due to yawing are relatively unimportant. S.E.S.

N79-15095# ARO, Inc., Arnold Air Force Station, Tenn.
AIRCRAFT MOTION SENSITIVITY TO VARIATIONS IN DYNAMIC STABILITY PARAMETERS
R. W. Butler and T. F. Langham *In* AGARD Dyn. Stability Parameters Nov. 1978 11 p refs Sponsored by the Air Force (For primary document see N79-15061 06-08)
Avail: NTIS HC A99/MF A01

A 6-DOF nonlinear and 5-DOF linearized dynamic sensitivity study was conducted on a fighter/bomber and attack type aircraft. The dynamic derivatives investigated in the study were C sub l sub q, C sub n sub q, C sub m sub r, C sub l sub Beta, and C sub n sub Beta. The cross-coupling derivatives C sub l sub q and C sub n sub q are shown to have significant effects on the aircraft motion in 1 g flight and 2 g turning flight while the derivatives C sub m sub r show little effect in the same regime. The acceleration derivatives C sub n sub Beta each have a significant influence on the aircraft motion in 1 g flight. The interactive nature of the dynamic derivatives in the aircraft equations of motion is documented. G.Y.

N79-15096# Systems Technology, Inc., Hawthorne, Calif.
IDENTIFICATION OF KEY MANEUVER-LIMITING FACTORS IN HIGH-ANGLE-OF-ATTACK FLIGHT
Donald E. Johnston *In* AGARD Dyn. Stability Parameters Nov. 1978 12 p refs (For primary document see N79-15061 06-08) (Contracts F33615-73-C-3101; F33615-76-C-3072)
Avail: NTIS HC A99/MF A01

Results of a current analytic and simulation investigation of maneuver-limiting (e.g., loss of control) factors in fighter aircraft at high angle-of-attack are reported. Two goals of the program are to identify the key parameters which result in high-angle-of-attack maneuver-limiting phenomena such as wing rock, nose slice, and rolling divergence and to demonstrate the influence of these key parameters in controlling the nature of the maneuver-limiting phenomena. This analysis and simulation have centered on unsymmetric flight. Author

N79-15097# Institut fuer Flugmechanik, Brunswick (West Germany).
GUST-VEHICLE PARAMETER IDENTIFICATION BY DYNAMIC SIMULATION IN WIND-TUNNELS
B. Krag *In* AGARD Dyn. Stability Parameters Nov. 1978 6 p (For primary document see N79-15061 06-08)
Avail: NTIS HC A99/MF A01

A description of the DFVLR (Deutsche Forschungs- und Versuchsanstalt fuer LUFT- und Raumfahrt) installation for dynamic simulation in wind tunnels is given. The application of this research installation in a research program and its capability and limitation are described. G.Y.

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

N79-15098# Quanta Systems Corp., Rockville, Md.
LIGHTING AND MARKING OF EXIT TAXIWAYS Final Report
Charles A. Douglas Aug. 1978 38 p refs Prepared for Naval Air Engineering Center, Lakehurst, N. J.
(Contracts N68335-78-C-2022; DOT-FA77WAI-786)
(AD-A060259; FAA-RD-78-94) Avail: NTIS HC A03/MF A01 CSCL 01/5

The feasibility of emphasizing the visibility of the throat of an exit taxiway by means of special lights was investigated in the literature. The use of green lights installed in the runway surface on the extended taxiway centerline marking is in common use for lighting both high speed and low speed exits was not adopted in the United States because of concern over the possibility of mistaking a low speed exit for a high speed exit. Tests to determine if this concern is valid are recommended. A system of pulsating blue lights at the entrance to the throat shows promise. Tests of this system are recommended. Modifying the type L-829 signs located at exits from the runway to increase their conspicuity, improved shielding of taxiway edge lights, use of asymmetric instead of symmetric lenses on straight stretches, dimming of taxiway edge lights would improve the guidance and reduce the sea-of-blue effect. Tests of these modifications are recommended. The use of high-efficiency retroreflective paint to mark the turn-offs to the exit taxiway will improve nighttime guide and is recommended. A.R.H.

N79-15099# Advanced Technology, Inc., McLean, Va.
TOWER AIRPORT STATISTICS HANDBOOK, CALENDAR YEAR 1977 Final Report
Ronald Hobbs and Winfred Wu 15 Jul. 1978 593 p
(Contract DOT-FA78WA-4151)
(AD-A060217; FAA-AVP-78-10) Avail: NTIS HC A25/MF A01 CSCL 01/5

Full year 1977 daily aircraft operations were obtained from 426 towered airports (424 operated by the Federal Aviation Administration (FAA)). A package of computer programs was used to perform statistical analyses on six user types of daily operations as reported on FAA Form 7230-1, Airport Traffic Record. The output of the computer programs displayed specific statistics in tabular and graphical format. The tabular statistics included means, standard deviations and peak occurrences computed for individual airports as well as various multiple airport groupings. Frequency distribution histograms and time curves are presented in a graphical format for the entire nationwide set of FAA towered airports. B.B.

N79-15100# Air Force Systems Command, Tyndall AFB, Fla. ADTC.
DYNAMIC RESPONSE OF AIRCRAFT TO UNLOADED AND LOADED PAVEMENT PROFILES Final Report
William H. Highter and Mark R. Snyder Aug. 1978 62 p refs
(Contract DOT-FA73WAI-361)
(AD-A059787; CEEDO-TR-77-42; FAA-RD-77-160) Avail: NTIS HC A04/MF A01 CSCL 01/5

The simulated dynamic response of an F-4C aircraft traversing either an unloaded (undeflected) or loaded (deflected) pavement profile is examined. The Air Force computer code, TAXI, was adapted for use on the Clarkson College IBM 360 Model 65 computer from the CDC 6600 computer used by the Air Force Civil Engineering Center. The TAXI code calculates the vertical accelerations at three points on an aircraft as the aircraft traverses a pavement profile. It appears that there is no significant difference in the response of TAXI to unloaded and loaded pavement profiles at speeds up to 133.3 feet per second. At higher speeds some rejections of the mean do occur, but in light of the continuous acceptance of the test of the distribution and the predominant acceptance of the test of the mean, these are felt to be insignificant. It appears that the present practice of using unloaded pavement profiles for aircraft dynamic response simulation is acceptable and loaded pavement profiles need not be obtained for this purpose. J.M.S.

N79-15101*# Research Triangle Inst., Research Triangle Park, N. C. Systems and Measurements Div.
SYSTEMS DEVELOPMENT OF A STALL/SPIN RESEARCH FACILITY USING REMOTELY CONTROLLED/AUGMENTED AIRCRAFT MODELS. VOLUME 1: SYSTEMS OVERVIEW
R. J. Montoya, A. R. Jai, and C. D. Parker Jan. 1979 87 p refs
(Contract NAS1-14638; RTI Proj. 43U-1362)
(NASA-CR-145351; RTI/1362-00-01F) Avail: NTIS HC A05/MF A01 CSCL 14B

A ground based, general purpose, real time, digital control system simulator (CSS) is specified, developed, and integrated with the existing instrumentation van of the testing facility. This CSS is built around a PDP-11/55, and its operational software was developed to meet the dual goal of providing the immediate capability to represent the F-18 drop model control laws and the flexibility for expansion to represent more complex control laws typical of control configured vehicles. Overviews of the two CSS's developed are reviewed as well as the overall system after their integration with the existing facility. Also the latest version of the F-18 drop model control laws (REV D) is described and the changes needed for its incorporation in the digital and analog CSS's are discussed. B.B.

N79-15102# Army Research Inst. for the Behavioral and Social Sciences, Alexandria, Va.
EVALUATION OF A FLIGHT SIMULATOR (DEVICE 2B24) FOR MAINTAINING INSTRUMENT PROFICIENCY AMONG INSTRUMENT-RATED ARMY PILOTS
Donald O. Weitzman, Michael L. Fineberg, and George L. Compton Jul. 1978 37 p refs
(AD-A060557; ARI-TP-298) Avail: NTIS HC A03/MF A01 CSCL 14/2

The research aims to evaluate the operational suitability of Device 2B24, which simulates the UH-1H helicopter, for facilitating UH-1H instrument proficiency training and proficiency assessment among instrument rated pilots. The present data indicate that substantial amounts of UH-1H time can be substituted by Device 2B24 time in instrument proficiency training and proficiency assessment. With simulators, the Army has the opportunity to establish an instrument training program that can maintain and assess instrument proficiency year round and at a reasonable cost. A reasonable conclusion from this study is that a realistic instrument training program that includes simulator training would reduce accidents and enhance combat readiness among instrument rated pilots. Author (GRA)

N79-15103# Singer Co., Sunnyvale, Calif. Link Div.
ADVANCED DIGITAL SIMULATOR SYSTEM (ADSS) Final Report
Jul. 1978 169 p ref
(Contract DAAK70-77-C-0175)
(AD-A059536) Avail: NTIS HC A08/MF A01 CSCL 15/4

A digital simulation system designed for the laboratory evaluation of various types of sensors, either singly or as weapon systems, permits simulation not only of the intrinsic qualities (bandwidth, resolution, range, frequency, etc.) but also of the operating environment such as helicopter, fixed wing, RVP. The system comprises an executive computer to control the overall simulation tasks, a sensor simulator that is easily programmable to model any sensor under evaluation, possibly a microwave simulator to model any radar device, a readily modified CRT display, a data base that includes terrain, culture, moving targets and ordnance, and a scoring (evaluation) console. A.R.H.

N79-15104# Tufts Univ., Medford, Mass.
METHOD FOR CONTINUOUS PURIFICATION OF BIOLOGICAL MATERIAL USING IMMUNOSORBENT M.S. Thesis
J. J. Hughes Jun. 1978 111 p refs
(Grant NSF APR-75-09973)
(PB-285999/9; NSF/RA-780128) Avail: NTIS HC A06/MF A01 CSCL 14B

A system for the continuous purification of biological material using immunosorbent was developed. The components of the system included heat sealed nylon pouches which support sepharose antibody, attached to an endless 35 mm mylar belt. A batch system for the purification of human placental alkaline phosphatase using immobilized rabbit antisera (22) was modified and tested for continuous separation in the machine. Enzyme was purified 26 fold to a final specific activity of 39 units/mg from an initial specific activity of 1.5 units/mg. The belt contained an early date, low affinity immunosorbent and made 5 complete passes through the system. GRA

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N79-15105# Committee on Commerce, Science, and Transportation (U. S. Senate).
SYMPOSIUM ON THE FUTURE OF SPACE SCIENCE AND SPACE APPLICATIONS
Washington GPO 1978 114 p refs Hearing before the Subcomm. on Sci., Technol., and Space of the Comm. on Commerce, Sci., and Transportation, 95th Congr. 2d Sess., 7 Feb. 1978
(GPO-23-876) Avail: Subcomm. on Sci., Technol., and Space

Current and projected uses of space technology and sciences to meet human needs on Earth and in space are discussed. Factors influencing mission priorities are considered as well as methods for cost/benefit analyses. For individual titles, see N79-15106 through N79-15112.

N79-15106# European Space Agency, Paris (France).
STATEMENT OF DOCTOR GEORGE VANREETH, DIRECTOR

OF ADMINISTRATION, EUROPEAN SPACE AGENCY, PARIS, FRANCE

George VanReeth *In* Comm. on Commerce, Sci., and Transportation (U. S. Senate) Symp. on the Future of Space Sci. and Space Appl. 1978 p 2-8 (For primary document see N79-15105 06-12)

Avail: Subcomm. on Sci., Technol., and Space

An overview of the European Space Agency's history, organization, and programs in space transportation, space sciences, and space applications is presented. Current and future activities described concern: Spacelab; the faint object camera and solar arrays for NASA's space telescope; the EXOSAT satellite for locating X-ray stars; Solar Polar Mission participation; Ariane launch vehicle use in space transportation; the development of microwave sensors for the European remote sensing program; the orbital test satellite program (OTS) to develop satellites for telephony and TV relay; the MAROTS satellite for commercial maritime navigation; and EARTHNET, the earth resources satellite data network. A.R.H.

N79-15107# Aerospace Corp., El Segundo, Calif.

STATEMENT OF IVAN BEKEY, DIRECTOR OF ADVANCED MISSION STUDIES, AEROSPACE CORPORATION

Ivan Bekey *In* Comm. on Commerce, Sci., and Transportation (U. S. Senate) Symp. on the Future of Space Sci. and Space Appl. 1978 p 9-27 (For primary document see N79-15105 06-12)

Avail: Subcomm. on Sci., Technol., and Space

The main problems facing the United States space programs are social and political rather than technological. Long range goals must be established for space, and the space program must provide bold and imaginative services which can be relevant in the everyday lives of citizens, as well as to business and government at all levels, using space systems that can pay their own way and attract private capital. Such advances as large heavy complex communications satellites will permit the use of tiny and cheap user terminals for personal wrist radios, personal emergency panic buttons to summon help, law enforcement communications, electronic mail, and the continuous tracking of all nuclear fuel shipments to prevent undetected diversion or hijacking. Observations spacecraft growing out of current meteorological and earth resource satellites will permit dial-up images for farmers and other concerned individuals. Other benefits are to be derived from space processing, space manufacturing, space-based energy transmission to Earth, and space disposal of nuclear wastes. A.R.H.

N79-15108# Space Global, La Jolla, Calif.

STATEMENT OF DOCTOR KRAFFT A. EHRICKE, PRESIDENT, SPACE GLOBAL, LA JOLLA, CALIFORNIA

Krafft A. Ehricke *In* Comm. on Commerce, Sci. and Transportation (U.S. Senate) Symp. on the Future of Space Sci. and Space Appl. 1978 p 11-27 refs (For primary document see N79-15105 06-12)

Avail: Subcomm. on Sci., Technol., and Space

The social, economic, and political aspects of the aerospace-related industries and of projected space industrialization are discussed with emphasis on jobs, energy, and national prestige. The nation's economic base is eroding and space industrialization presents the opportunity to convert capital-intensive technologies into labor-intensive industries through public and private enterprises. World population shifts and the dwindling minorities of leading industrial nations indicate that the economic survival of the U.S. may well depend on making transition to fully developed space industrialization capabilities. A.R.H.

N79-15109# Hudson Inst., Inc., Croton-on-Hudson, N. Y.

STATEMENT OF DOCTOR WILLIAM M. BROWN, DIRECTOR, TECHNOLOGICAL STUDIES, HUDSON INSTITUTE, CROTON-ON-HUDSON, NEW YORK

William M. Brown *In* Comm. on Commerce, Sci., and Transportation (U. S. Senate) Symp. on the Future of Space Sci. and Space Appl. 1978 p 31-40 refs (For primary document see N79-15105 06-12)

Avail: Subcomm. on Sci., Technol., and Space

A major conclusion of the 'Long Term Prospects for Development Space' study completed for NASA is that the enormous potential for the future of space almost certainly will be realized; only the timing is at question. The difference between optimistic and pessimistic projections appears likely to be a factor of 2; that is, 100 years is enough to accomplish miracles which well might be done in 50, or 200 years those which might occur in 100. Development, however, may be thwarted by deliberate threats or actions, or by wanton neglect to accomplish the necessary housekeeping (the timely removal of all nonfunctioning satellites and other space debris). The nature of a space development and the rate at which it will proceed will be determined by a number of key factors: successful technology, tourism, positive health considerations, interactions with earth, and the quality of 'frontier life' (favorable social dynamics, benign politics, and rapid economic growth). A.R.H.

N79-15110# ECON, Inc., Princeton, N. J.

STATEMENT OF DOCTOR KLAUS HEISS, PRESIDENT, ECON, INCORPORATED, PRINCETON, NEW JERSEY

Klaus Heiss *In* Comm. on Commerce, Sci. and Transportation (U. S. Senate) Symp. on the Future of Space Sci. and Space Appl. 1978 p 40-55 refs (For primary document see N79-15105 06-12)

Avail: Subcomm. on Sci., Technol., and Space

The economic self-interest of the United States over a horizon broader than the next 20 years will lead ultimately to some exciting adventures including establishments of space energy bases and space habitats. The time horizon is to the year 2075. At this juncture of the U.S. space program, a major opportunity exits to give a new impetus to space applications and sciences for the next two decades. This opportunity involves a redirection of the funding of space programs from an emphasis on means (rocket systems and space transportation systems) to an emphasis on the goals of space ventures in applications, sciences, and long term in-orbit activities by man. Four transfer application themes discussed include: global information systems, large space structure capability, space as an energy base, phases of space industrialization, and space habitation. Cost benefits and funding requirements for these ventures are projected. A.R.H.

N79-15111# National Aeronautics and Space Administration, Washington, D. C.

STATEMENT OF DOCTOR ROBERT A. FROSCH, ADMINISTRATOR, NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Robert A. Frosch *In* Comm. on Commerce, Sci. and Transportation (U. S. Senate) Symp. on the Future of Space Sci. and Space Appl. 1978 p 55-62 (For primary document see N79-15105 06-12)

Avail: Subcomm. on Sci., Technol., and Space

Short term views must be taken in order to concentrate on the foundations and steps to be followed in the next 10 years so that the need for, economics, and tangible values of long range dreams can be fully understood. Although the technological basis for many projected applications already exist, there is difficulty in obtaining funding for the initial steps toward the realization of any venture unless a quantitative basis can be demonstrated for the costs and benefits to be achieved. Computations are exaggerated for space systems because of their extreme front-end capitalization problems. The investment for satellite solar-powered satellite systems is comparable in magnitude to that contemplated for other energy systems, although there is a difference in the economics of the problem and in the technologies of the problem. A.R.H.

N79-15112# National Aeronautics and Space Administration, Washington, D. C.

STATEMENT OF DOCTOR NOEL HINNERS, ASSOCIATE ADMINISTRATOR FOR SPACE SCIENCES, NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Noel Hinners *In* Comm. on Commerce, Sci. and Transportation (U. S. Senate) Symp. on the Future of Space Sci. and Space Appl. 1978 p 74-90 (For primary document see N79-15105 06-12)

Avail: Subcomm. on Sci., Technol., and Space

Leadership in space exploration is an important part of the nation's prestige. There is a large science component in what are called applications and visa versa. Space science can provide the basis for some of the steps and bridges to possibilities envisioned for the year 2000 and forward. Both chemistry and

physics are basis priorities in NASA missions and research activities. Current programs are concerned with developing the capability to put more weight in space, to provide for revisiting facilities such as the space telescope and provide for on-orbit repair or retrieval. Programs requiring the construction of facilities in space require higher levels of energy than those currently available. The prospective development of low-thrust propulsion in the 1980's will reduce transportation time. Data from Skylab and that to be obtained from Spacelab as well as investigations of solar-terrestrial interactions will benefit space tourists and inhabitants. A.R.H.

N79-15113*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
OAST SPACE THEME WORKSHOP. VOLUME 1: SUMMARY REPORT. 1: INTRODUCTION. 2: GENERAL OBSERVATIONS AND SOME KEY FINDINGS. 3: FOLLOW-ON ACTIVITY. QUICK-LOOK COMMENTS AND WORKING PAPERS
1976 77 p Workshop held at Langley Station, Va., 26-30 Apr. 1976 17 Vol.
(NASA-TM-80001) Avail: NTIS HC A05/MF A01 CSCL 22A

The Outlook for Space Study, consideration of National needs and OAST technology goals were factors in the selection of the following themes for candidate technical initiative and supporting program plans: space power station; search for extraterrestrial life; industrialization of space; global service station; exploration of the solar system; and advanced space transportation system. An overview is presented of the Space Theme Workshop activities in developing technology needs, program requirements, and proposed plans in support of each theme. The unedited working papers used by team members are included. A.R.H.

N79-15114*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
OAST SPACE THEME WORKSHOP. VOLUME 2: THEME SUMMARY. 1: SPACE POWER (NO. 7). A. THEME STATEMENT. B. 26 APRIL 1976 PRESENTATION. C. SUMMARY. D. INITIATIVE ACTION
1976 35 p refs Workshop held at Langley Station, Va., 26-30 Apr. 1976 17 Vol.
(NASA-TM-80002) Avail: NTIS HC A03/MF A01 CSCL 22A

A long-lived space-based system that converts on-orbit solar and/or nuclear energy to a suitable form for distribution to using space systems is described. Mission applications, requirements, issues, problems, benefits, and technology thrusts are identified for the multipurpose power platform. Power levels of at least 10-100Kw are required for space manufacturing, satellites, and space station operations. Two Mw are needed for a proposed passive radar system. Propulsion system requirements are in the 100Kw-100Mw range. A.R.H.

N79-15115*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
OAST SPACE THEME WORKSHOP. VOLUME 2: THEME SUMMARY. 2: SPACE INDUSTRIALIZATION (NO. 8). A. THEME STATEMENT. B. 26 APRIL 1976 PRESENTATION. C. SUMMARY STATEMENT. D. INITIATIVE ACTION (FORM 5)
1976 30 p Workshop held at Langley Station, Va., 26-30 Apr. 1976 17 Vol.
(NASA-TM-80003) Avail: NTIS HC A03/MF A01 CSCL 22A

Enabling technology needs and other requirements to support space industrialization include: large space structures; fabrication and joining processes; single stage to orbit and heavy lift launch vehicles; nuclear and solar space power systems; robotics, manipulators, and teleoperators; biotechnology in space; artificial gravity; the utilization of lunar materials for construction; and the extraction of oxygen and metals from lunar resources. New initiatives (FY 1978) directly supportive or partly related to space industrialization are listed. A.R.H.

N79-15116*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
OAST SPACE THEME WORKSHOP. VOLUME 2: THEME SUMMARY. 3: SEARCH FOR EXTRATERRESTRIAL INTELLIGENCE (NO. 9). A: THEME STATEMENT. B. 26 APRIL 1976 PRESENTATION. C. SUMMARY. D. NEWER INITIATIVES (FORM 4). E. INITIATIVE ACTIONS (FORM 5)
1976 72 p Workshop Held at Langley Station, Va., 26-30 Apr. 1976 7 Vol.
(NASA-TM-80004) Avail: NTIS HC A04/MF A01 CSCL 22A

Preliminary (1977-1983), intermediate (1982-1988), and long term (1989+) phases of the search for extraterrestrial intelligence (SETI) program are examined as well as the benefits to be derived in radioastronomy and the problems to be surmounted in radio frequency interference. The priorities, intrinsic value, criteria, and strategy for the search are discussed for both terrestrial and lunar-based CYCLOPS and for a space SETI system located at lunar liberation point L4. New initiatives related to antenna independent technology, multichannel analyzers, and radio frequency interference shielding are listed. Projected SETI program costs are included. A.R.H.

N79-15117*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
OAST SPACE THEME WORKSHOP. VOLUME 2: THEME SUMMARY. 4: SOLAR SYSTEM EXPLORATION (NO. 10). A: STATEMENT OF THEME. B. 26 APRIL 1976 PRESENTATION. C. SUMMARY D. INITIATIVE ACTIONS (FORM 5)
1976 61 p Workshop held at Langley Station, Va., 26-30 Apr. 1976 7 Vol.
(NASA-TM-80005) Avail: NTIS HC A04/MF A01 CSCL 22A

Major strategies for exploring the solar system focus on the return of information and the return of matter. Both the planetary exploration facility, and an orbiting automated space station, and the sample return and exploration facility have similar requirements. The single most essential need to enable intensive study of the outer solar system is nuclear propulsion and power capability. New initiatives in 1978 related to the reactor, data and sample acquisition and return, navigation, and environmental protection are examined. A.R.H.

N79-15118*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
OAST SPACE THEME WORKSHOP. VOLUME 2: THEME SUMMARY. 5: GLOBAL SERVICE (NO. 11). A. STATEMENT. B. 26 APRIL 1976 PRESENTATION. C. SUMMARY
1976 45 p Workshop held at Langley Station, Va., 26-30 Apr. 1976 17 Vol.
(NASA-TM-80006) Avail: NTIS HC A03/MF A01 CSCL 22A

The benefits to be obtained from cost-effective global observation of the earth, its environment, and its natural and man-made features are examined using typical spacecraft and missions which could enhance the benefits of space operations. The technology needs and areas of interest include: (1) a ten-fold increase in the dimensions of deployable and erectable structures to provide booms, antennas, and platforms for global sensor systems; (2) control and stabilization systems capable of pointing accuracies of 1 arc second or less to locate targets of interest and maintain platform or sensor orientation during operations; (3) a factor of five improvements in spacecraft power capacity to support payloads and supporting electronics; (4) auxiliary propulsion systems capable of 5 to 10 years on orbit operation; (5) multipurpose sensors; and (6) end-to-end data management and an information system configured to accept new components or concepts as they develop. A.R.H.

N79-15119*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
OAST SPACE THEME WORKSHOP. VOLUME 2: THEME SUMMARY. 6: ADVANCED TRANSPORTATION SYSTEMS. A: THEME STATEMENT. B. 26 APRIL 1976 PRESENTATION. C. THEME SUMMARY. D. INITIATIVE ACTIONS
1976 44 p Workshop held at Langley Station, Va., 26-30 Apr. 1979 17 Vol.
(NASA-TM-80007) Avail: NTIS HC A03/MF A01 CSCL 22A

Technology requirements for an integrated space transportation system capability which will allow the nation to use space efficiently, reliably, and routinely in the years between 1985 and 2000 with a significant return on invested resources will build on the currently defined space transportation system using shuttle, the IUS, and the advanced upper stage such as the solar electric propulsion system. Contributing technologies should

include those which support (1) total reusability with minimal refurbishment; (2) responsiveness to high launch rate requirements when operation and energy are the predominant recurring costs; and (3) maximum flexibility in operation between earth and LEO and between LEO and GEO. Initiatives undertaken to advance the heavy lift to launch vehicles, single stage to orbit vehicles, and orbit transfer vehicles are listed. A.R.H.

N79-15120*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
OAST SPACE THEME WORKSHOP. VOLUME 3: WORKING GROUP SUMMARY. 1: NAVIGATION, GUIDANCE, CONTROL (E-1) A. STATEMENT. B. TECHNOLOGY NEEDS (FORM 1). C. PRIORITY ASSESSMENT (FORM 2)
1976 60 p Workshop held at Langley Station, Va., 26-30 Apr. 1976 17 Vol.
(NASA-TM-80008) Avail: NTIS HC A04/MF A01 CSCL 22A

The six themes identified by the Workshop have many common navigation guidance and control needs. All the earth orbit themes have a strong requirement for attitude, figure and stabilization control of large space structures, a requirement not currently being supported. All but the space transportation theme have need for precision pointing of spacecraft and instruments. In addition all the themes have requirements for increasing autonomous operations for such activities as spacecraft and experiment operations, onboard mission modification, rendezvous and docking, spacecraft assembly and maintenance, navigation and guidance, and self-checkout, test and repair. Major new efforts are required to conceptualize new approaches to large space antennas and arrays that are lightweight, readily deployable, and capable of precise attitude and figure control. Conventional approaches offer little hope of meeting these requirements. Functions that can benefit from increasing automation or autonomous operations are listed. A.R.H.

N79-15121*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
OAST SPACE THEME WORKSHOP. VOLUME 3: WORKING GROUP SUMMARY. 2: DATA HANDLING, COMMUNICATIONS (E-2). A. STATEMENT. B. TECHNOLOGY NEEDS (FORM 1). C. PRIORITY ASSESSMENT (FORM 2)
1976 96 p Workshop held at Langley Station, Va., 26-30 Apr. 1976 17 Vol.
(NASA-TM-80009) Avail: NTIS HC A05/MF A01 CSCL 22A

Technologies required to support the stated OAST thrust to increase information return by X1000, while reducing costs by a factor of 10 are identified. The most significant driver is the need for an overall end-to-end data system management technology. Maximum use of LSI component technology and trade-offs between hardware and software are manifest in most all considerations of technology needs. By far, the greatest need for data handling technology was identified for the space Exploration and Global Services themes. Major advances are needed in NASA's ability to provide cost effective mass reduction of space data, and automated assessment of earth looking imagery, with a concomitant reduction in cost per useful bit. A combined approach embodying end-to-end system analysis, with onboard data set selection, onboard data processing, highly parallel image processing (both ground and space), low cost, high capacity memories, and low cost user data distribution systems would be necessary. A.R.H.

N79-15122*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
OAST SPACE THEME WORKSHOP. VOLUME 3: WORKING GROUP SUMMARY. 3: SENSORS (E-3). A. STATEMENT. B. TECHNOLOGY NEEDS (FORM 1). C. PRIORITY ASSESSMENT (FORM 2). D. ADDITIONAL ASSESSMENT
1976 167 p Workshop held at Langley Station, Va., 26-30 Apr. 1976 17 Vol.
(NASA-TM-80010) Avail: NTIS HC A08/MF A01 CSCL 22A

Developments required to support the space power, SETI, solar system exploration and global services programs are identified. Instrumentation and calibration sensors (rather than scientific) are needed for the space power system. Highly sophisticated receivers for narrowband detection of microwave sensors and sensors for automated stellar cataloging to provide a mapping data base for SETI are needed. Various phases of solar system exploration require large area solid state imaging arrays from UV to IR; a long focal plane telescope; high energy particle detectors; advanced spectrometers; a gravitometer; and atmospheric distanalyzer; sensors for penetrometers; in-situ sensors for surface chemical analysis, life detection, spectroscopic and microscopic analyses of surface soils, and for meteorological measurements. Active and passive multiapplication sensors, advanced multispectral scanners with improved resolution in the UV and IR ranges, and laser techniques for advanced probing and oceanographic characterization will enhance for global services. A.R.H.

N79-15123*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
OAST SPACE THEME WORKSHOP. VOLUME 3: WORKING GROUP SUMMARY. 4: SOFTWARE (E-4). A. SUMMARY. B. TECHNOLOGY NEEDS (FORM 1). C. PRIORITY ASSESSMENT (FORM 2)
1976 50 p Workshop held at Langley Station, Va., 26-30 Apr. 1976 17 Vol.
(NASA-TM-80011) Avail: NTIS HC A03/MF A01 CSCL 22A

Only a few efforts are currently underway to develop an adequate technology base for the various themes. Particular attention must be given to software commonality and evolutionary capability, to increased system integrity and autonomy; and to improved communications among the program users, the program developers, and the programs themselves. There is a need for quantum improvement in software development methods and increasing the awareness of software by all concerned. Major thrusts identified include: (1) data and systems management; (2) software technology for autonomous systems; (3) technology and methods for improving the software development process; (4) advances related to systems of software elements including their architecture, their attributes as systems, and their interfaces with users and other systems; and (5) applications of software including both the basic algorithms used in a number of applications and the software specific to a particular theme or discipline area. The impact of each theme on software is assessed. A.R.H.

N79-15124*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
OAST SPACE THEME WORKSHOP. VOLUME 3: WORKING GROUP SUMMARY. 5: PROPULSION (P-1). A. SUMMARY STATEMENT. B. TECHNOLOGY NEEDS (FORM 1). C. PRIORITY ASSESSMENTS (FORM 2)
1976 118 p Workshop held at Langley Station, Va., 26-30 Apr. 1976 17 Vol.
(NASA-TM-80012) Avail: NTIS HC A06/MF A01 CSCL 22A

All themes require some form of advanced propulsion capabilities to achieve their stated objectives. Requirements cover a broad spectrum ranging from a new generation of heavy lift launch vehicles to low thrust, long lift system for on-orbit operations. The commonality extant between propulsive technologies was established and group technologies were grouped into vehicle classes by functional capability. The five classes of launch vehicles identified by the space transportation theme were augmented with a sixth class, encompassing planetary and on-orbit operations. Propulsion technologies in each class were then ranked, and assigned priority numbers. Prioritized technologies were matched to theme requirements. A.R.H.

N79-15125*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
OAST SPACE THEME WORKSHOP. VOLUME 3: WORKING GROUP SUMMARY. 6: POWER (P-2). A. STATEMENT. B. TECHNOLOGY NEEDS (FORM 1). C. PRIORITY ASSESSMENT (FORM 2)
1976 123 p Workshop held at Langley Station, Va., 26-30 Apr. 1976 17 Vol.
(NASA-TM-80013) Avail: NTIS HC A06/MF A01 CSCL 22A

Power requirements for the multipurpose space power platform, for space industrialization, SETI, the solar system exploration facility, and for global services are assessed for various launch dates. Priorities and initiatives for the development of elements of space power systems are described for systems using light power input (solar energy source) or thermal power

input, (solar, chemical, nuclear, radioiosotopes, reactors). Systems for power conversion, power processing, distribution and control are likewise examined. A.R.H.

N79-15126*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
OAST SPACE THEME WORKSHOP. VOLUME 3: WORKING GROUP SUMMARY. 7: MATERIAL (M-1). A. STATEMENT. B. TECHNOLOGY NEEDS (FORM 1). C. PRIORITY ASSESSMENT (FORM 2)
1976 127 p Workshop held at Langley Station, Va., 26-30 Apr. 1976 17 Vol.
(NASA-TM-80014) Avail: NTIS HC A07/MF A01 CSCL 22A

The approach of matching technology areas with various themes needs was not effective for the materials and thermal control discipline because of the diversity of requirements for each. Top priorities were evolved from the advanced space transportation system and the space power platform because these are essential building blocks in fulfilling some of the other themes. Important needs identified include life long-life cryogenic cooling systems for sensors, masers, and other devices and the needs for lightweight nuclear shielding materials for nuclear electric propulsion. A.R.H.

N79-15127*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
OAST THEME WORKSHOP. VOLUME 3: WORKING GROUP SUMMARY. 8: STRUCTURES, DYNAMICS (M-2). A. STATEMENT. B. TECHNOLOGY NEEDS (FORM 1). C. PRIORITY ASSESSMENTS (FORM 2)
1976 39 p Workshop held at Langley Station, Va., 26-30 Apr. 1976 17 Vol.
(NASA-TM-80015) Avail: NTIS HC A03/MF A01 CSCL 22A

A technology program on large space structures was defined to respond to common need perceived for five of the six themes. Greatly expanded power, facilities, and communications/sensing requirements appear to demand a new structures technology for construction in space. Requirements to construct huge structural arrays with precision surfaces in space will need creative research efforts to identify practical structural elements and construction techniques. Requirements for advanced transportation structures were defined to respond to the space transportation theme. Because of the criticality of thermal structures to achieve lower cost transportation systems, renewed emphasis on technology in this area is recommended. A second technology needing renewed emphasis is the area of recovery and landing technology structures to permit full reuse of launch vehicle propulsion elements. A.R.H.

N79-15128*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
OAST SPACE THEME WORKSHOP. VOLUME 3: WORKING GROUP SUMMARY. 9: AEROTHERMODYNAMICS (M-3). A: STATEMENT. B: TECHNOLOGY NEEDS (FORM 1). C. PRIORITY ASSESSMENT (FORM 2). D. ADDITIONAL ASSESSMENTS
1976 35 p Workshop held at Langley Station, Va., 26-30 Apr. 1976 17 Vol.
(NASA-TM-80016) Avail: NTIS HC A03/MF A01 CSCL 22A

Twelve aerothermodynamic space technology needs were identified to reduce the design uncertainties in aerodynamic heating and forces experienced by heavy lift launch vehicles, orbit transfer vehicles, and advanced single stage to orbit vehicles for the space transportation system, and for probes, planetary surface landers, and sample return vehicles for solar system exploration vehicles. Research and technology needs identified include: (1) increasing the fluid dynamics capability by at least two orders of magnitude by developing an advanced computer processor for the solution of fluid dynamic problems with improved software; (2) predicting multi-engine base flow fields for launch vehicles; and (3) developing methods to conserve energy in aerothermodynamic ground test facilities. A.R.H.

N79-15129*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
OAST SPACE THEME WORKSHOP. VOLUME 4: R AND T BASE SUMMARY. A: APRIL 26, 1976, PRESENTATION. B: SUMMARY STATEMENT
1976 30 p Workshop held at Langley Station, Va., 26-30 Apr. 1976 17 Vol.
(NASA-TM-80017) Avail: NTIS HC A03/MF A01 CSCL 22A

The research and technology base program was examined to determine those tasks which either enabled or enhanced a theme and should be incorporated into that theme, and to identify new and promising R&T candidates which should be incorporated into the R&T base to meet essential long range space technology goals not addressed by the various themes. Candidates in the ongoing tasks category generally reflect the reorientation or pursuit of an ongoing RTOP on specific theme objectives, primarily involving the development and ground testing of new technology components and systems. Thirty-eight recommended candidate tasks are listed. A.R.H.

N79-15130*# Vought Corp., Dallas, Tex.
LOW ENERGY STAGE STUDY. VOLUME 1: EXECUTIVE SUMMARY
Aug. 1978 42 p
(Contract NAS8-32710)
(NASA-CR-150893; Rept-2-55910/8R-3483-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 22A

Cost effective approaches for placing automated payloads into circular and elliptical orbits using energy requirements significantly lower than that provided by the smallest, currently planned shuttle upper stage, SSUS-D, were investigated. Launch costs were derived using both NASA existing/planned launch approaches as well as new propulsion concepts meeting low-energy regime requirements. Candidate new propulsion approaches considered were solid (tandem, cluster, and controlled), solid/liquid combinations and all-liquid stages. Results show that the most economical way to deliver the 129 low energy payloads is basically with a new modular, short liquid bipropellant stage system for the large majority of the payloads. For the remainder of the payloads, use the shuttle with integral OMS and the Scout form for a few specialized payloads until the Shuttle becomes operational. A.R.H.

N79-15131*# Vought Corp., Dallas, Tex.
LOW ENERGY STAGE STUDY. VOLUME 2: REQUIREMENTS AND CANDIDATE PROPULSION MODES
Aug. 1978 144 p refs
(Contract NAS8-32710)
(NASA-CR-150894; Rept-2-55910/8R-3483-Vol-2) Avail: NTIS HC A07/MF A01 CSCL 22A

A payload mission model covering 129 launches, was examined and compared against the space transportation system shuttle standard orbit inclinations and a shuttle launch site implementation schedule. Based on this examination and comparison, a set of six reference missions were defined in terms of spacecraft weight and velocity requirements to deliver the payload from a 296 km circular Shuttle standard orbit to the spacecraft's planned orbit. Payload characteristics and requirements representative of the model payloads included in the regime bounded by each of the six reference missions were determined. A set of launch cost envelopes were developed and defined based on the characteristics of existing/planned Shuttle upper stages and expendable launch systems in terms of launch cost and velocity delivered. These six reference missions were used to define the requirements for the candidate propulsion modes which were developed and screened to determine the propulsion approaches for conceptual design. A.R.H.

N79-15132*# Vought Corp., Dallas, Tex.
LOW ENERGY STAGE STUDY. VOLUME 3: CONCEPTUAL DESIGN, INTERFACE ANALYSIS, FLIGHT AND GROUND OPERATIONS
Aug. 1978 224 p refs
(Contract NAS8-32710)
(NASA-CR-150895; Rept-2-55910/8R-3483-Vol-3) Avail: NTIS HC A10/MF A01 CSCL 22A

Low energy conceptual stage designs and adaptations to existing/planned shuttle upper stages were developed and their performance established. Selected propulsion modes and subsystems were used as a basis to develop airborne support equipment (ASE) design concepts. Orbiter installation and integration (both physical and electrical interfaces) were defined. Low energy stages were adapted to the orbiter and ASE

interfaces. Selected low energy stages were then used to define and describe typical ground and flight operations. A.R.H.

N79-15133*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MISSION SUMMARY: HALLEY FLYBY/TEMPEL-2 RENDEZVOUS
Ken Atkins 15 Jan. 1979 13 p
(Contract NAS7-100)
(NASA-CR-158072; JPL-Pub-79-4) Avail: NTIS HC A02/MF A01 CSCL 22A

A unique dual-comet flight opportunity exists in mid-1985 which includes flyby of the large and active comet Halley en route to rendezvous with second comet, Tempel-2. This mission will utilize ion propulsion at a modest performance level, based on proven technology. The Project is planned for FY81 start. Launch occurs in July 1985 via the Shuttle/IUS twin stage. Following IUS injection, the ion propulsion stage provides continuous thrust virtually throughout the 3-year flight until the Tempel-2 rendezvous in 1988. En route, a probe is deployed for encounter with Halley about 4 months after launch at a point 73 days before its perihelion. Rendezvous with Tempel-2 occurs about 60 days before the comet's perihelion during the summer of 1988 and continues for about 1 year. Earth will be in favorable relative positions for observing both the flyby and the rendezvous. Author

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

No abstracts in this category.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

N79-15134*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TRACKING AND DATA SYSTEM SUPPORT FOR THE VIKING 1975 MISSION TO MARS: EXTENDED MISSION OPERATIONS, DECEMBER 1976 TO MAY 1978, VOLUME 4
D. J. Mudgway 15 Dec. 1978 31 p refs
(Contract NAS7-100)
(NASA-CR-157643; JPL-TM-33-783-Vol-4) Avail: NTIS HC A03/MF A01 CSCL 14B

The support which was provided by the Deep Space Network to the Viking Extended Mission from December 1976 to May 1978 is described. Tracking and data acquisition support required the continuous operation of a world-wide network of tracking stations with 64-meter and 26-meter diameter antennas, together with a global communications system for the transfer of commands, telemetry, and radio metric data between the stations and the Network Operations Control Center in Pasadena, California. Performance of the deep-space communications links between Earth and Mars, and innovative new management techniques for operations and data handling are included. F.O.S.

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N79-15135*# Aerospace Corp., El Segundo, Calif. Advanced Orbital Systems Div.
ON-ORBIT CHECKOUT OF SATELLITES, VOLUME 2. PART 3 OF ON-ORBIT CHECKOUT STUDY Final Report
Ernest I. Pritchard 15 May 1978 135 p
(Contract NASw-3099)
(NASA-CR-158053; ATR-78(7687)-1-Vol-2) Avail: NTIS HC A07/MF A01 CSCL 22A

Early satellite failures significantly degrading satellite operations are reviewed with emphasis on LANDSAT D, the Technology Demonstration Satellite, the ATREX/AEM spacecraft, STORMSAT 2, and the synchronous meteorological satellite. Candidates for correction with on-orbit checkout and appropriate actions are analyzed. On-orbit checkout subsystem level studies are summarized for electrical power, attitude control, thermal control, reaction control and propulsion, instruments, and angular rate matching for alignment of satellite IRU. A.R.H.

N79-15136# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
TECHNICAL INFORMATION ON METEOROLOGICAL SATELLITES [NOTA TECHNICA APT-W1]
Marlene Elias Oct. 1978 10 p In PORTUGUESE
(INPE-1383-TT/011) Avail: NTIS HC A02/MF A01

Information concerning the WEFAX data transmissions from the GEOS Satellites is presented. Schedules of transmissions and type of data for each satellite are given. Transl. by F.O.S.

N79-15137*# Rockwell International Corp., Downey, Calif. Space Div.
SATELLITE POWER SYSTEM (SPS) CONCEPT DEFINITION STUDY (EXHIBIT C) Quarterly Review, 21 - 22 Jun. 1978
Jun. 1978 371 p
(Contract NAS8-32475)
(NASA-CR-150733; SD-78-AD-0075; QR-1) Avail: NTIS HC A16/MF A01 CSCL 22B

The SPS program plan is outlined. An overall review of the component systems which comprise the SPS is presented. The report is presented in the form of charts, graphs, data tables, and engineering drawings. G.Y.

N79-15138*# Rockwell International Corp., Downey, Calif. Space Div.
SATELLITE POWER SYSTEMS (SPS) CONCEPT DEFINITION STUDY. VOLUME 3: SPS CONCEPT EVOLUTION Final Report
G. Hanley Apr. 1978 307 p
(Contract NAS8-32475)
(NASA-CR-158066; SD-78-AP-0023-3-Vol-3) Avail: NTIS HC A14/MF A01 CSCL 22B

A solar photovoltaic satellite based upon the utilization of a GaAlAs solar cell is defined. Topics covered include silicon-based photovoltaics, solar thermal power conversion, microwave energy transmission, power distribution, structures, attitude control and stationkeeping, thermal, and information management and control. A.R.H.

N79-15139*# Rockwell International Corp., Downey, Calif. Space Div.
SATELLITE POWER SYSTEMS (SPS) CONCEPT DEFINITION STUDY. VOLUME 5: TRANSPORTATION AND OPERATIONS ANALYSIS Final Report
G. Hanley Apr. 1978 195 p
(Contract NAS8-32475)
(NASA-CR-158067; SD-78-AP-0023-5-Vol-5) Avail: NTIS HC A09/MF A01 CSCL 22B

The development of transportation systems to support the operations required for the orbital assembly of a 5-gigawatt satellite is discussed as well as the construction of a ground receiving antenna (rectenna). Topics covered include heavy lift launch vehicle configurations for Earth-to LEO transport; the use of chemical, nuclear, and electric orbit transfer vehicles for LEO to GEO operations; personnel transport systems; ground operations; end-to-end analysis of the construction, operation, and maintenance of the satellite and rectenna; propellant production and storage; and payload packaging. A.R.H.

N79-15140*# Rockwell International Corp., Downey, Calif. Space Div.
SATELLITE POWER SYSTEMS (SPS) CONCEPT DEFINITION STUDY. VOLUME 6: SPS TECHNOLOGY REQUIREMENTS AND VERIFICATION Final Report
G. Hanley Apr. 1978 136 p 7 Vol.
(Contract NAS8-32475)
(NASA-CR-150685; SD-78-AP-0023-6-Vol-6) Avail: NTIS HC A07/MF A01 CSCL 22B

Volume 6 of the SPS Concept Definition Study is presented and also incorporates results of NASA/MSFC in-house effort. This volume includes a supporting research and technology summary. Other volumes of the final report that provide additional detail are as follows: (1) Executive Summary; (2) SPS System Requirements; (3) SPS Concept Evolution; (4) SPS Point Design Definition; (5) Transportation and Operations Analysis; and Volume 7, SPS Program Plan and Economic Analysis. G.Y.

N79-15141*# Rockwell International Corp., Downey, Calif. Space Div.
SATELLITE POWER SYSTEMS (SPS) CONCEPT DEFINITION STUDY. VOLUME 7: SPS PROGRAM PLAN AND ECONOMIC ANALYSIS Final Report
G. Hanley Apr. 1978 152 p
(Contract NAS8-32475)
(NASA-CR-158068; SD-78-AP-0023-7-Vol-7) Avail: NTIS HC A08/MF A01 CSCL 22B

The economic and programmatic requirements for a recommended SPS solar photovoltaic baseline concept were analyzed. Costs are determined for the DDT&E; initial capital investment (covers initial procurement and emplacement of each SPS plant and equipment); replacement capital investment (capital asset replacement over the SPS operating life); operations and maintenance (expendables, minor maintenance, repair crews); and taxes/insurance. A.R.H.

N79-15142*# Rockwell International Corp., Downey, Calif. Space Div.
SATELLITE POWER SYSTEMS (SPS) CONCEPT DEFINITION STUDY. VOLUME 7: SPS PROGRAM PLAN AND ECONOMIC ANALYSIS, APPENDIXES Final Report
G. Hanley Apr. 1978 270 p
(Contract NAS8-32475)
(NASA-CR-150702; SD-78-AP-0023-7-Vol-7-App) Avail: NTIS HC A12/MF A01 CSCL 22B

Three appendixes in support of Volume 7 are contained in this document. The three appendixes are: (1) Satellite Power System Work Breakdown Structure Dictionary; (2) SPS cost Estimating Relationships; and (3) Financial and Operational Concept. Other volumes of the final report that provide additional detail are: Executive Summary; SPS Systems Requirements; SPS Concept Evolution; SPS Point Design Definition; Transportation and Operations Analysis; and SPS Technology Requirements and Verification. G.Y.

N79-15143# RAMCOR, Inc., Vienna, Va.
NAVY SATELLITE OCEANOGRAPHIC RESEARCH PROGRAM (SOREP) PLAN. VOLUME 1: EXECUTIVE SUMMARY Final Report
Frank J. Augustine and Victor J. Lujetic 18 Sep. 1978 45 p
(Contract N00014-77-C-0320)
(AD-A060407; U-RC149A-002-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 22/2

The purpose of this document is to define the Navy operational and R and D requirements for oceanographic/marine atmospheric data as they derive from or relate to the fulfillment of Navy missions and warfare tasks. Having defined the requirements and objectives, this document further strives to relate these needs to the current and projected technical program of the U.S. Navy in the area of satellite remote sensing, to determine their adequacy and to suggest changes needed (if any) to guarantee that Navy and Marine Corps priority needs are met. This program plan will serve as a single technology and management reference for implementation and planning of Navy related satellite programs. Author (GRA)

N79-15144# RAMCOR, Inc., Vienna, Va.
NAVY SATELLITE OCEANOGRAPHIC RESEARCH PROGRAM (SOREP) PLAN. VOLUME 2: PROGRAM PLAN DETAILS Final Report
Frank J. Augustine and Victor J. Lujetic 18 Sep. 1978 49 p
(Contract N00014-77-C-0320)
(AD-A060408; U-RC149A-002-Vol-2) Avail: NTIS HC A03/MF A01 CSCL 22/2

The purpose of this document is to define the Navy operational and R and D requirements for oceanographic/marine atmospheric data as they derive from or relate to the fulfillment of Navy missions and warfare tasks. Having defined the requirements and objectives, this document further strives to relate these needs to the current and projected technical program of the U.S. Navy in the area of satellite remote sensing, to determine their adequacy and to suggest changes needed (if any) to guarantee that Navy and Marine Corps priority needs are met. This program plan will serve as a single technology and management reference for implementation and planning of Navy related satellite programs. Author (GRA)

N79-15145# Lincoln Lab., Mass. Inst. of Tech., Lexington.
FLYWHEEL COMPONENTS FOR SATELLITE APPLICATIONS
Alan R. Millner 16 May 1978 145 p
(Contract F19628-78-C-0002)
(AD-A060586; TN-1978-4; ESD-TR-78-97) Avail: NTIS HC A07/MF A01 CSCL 10/3

The following paper studies the possibilities of using high-speed flywheels with magnetic bearings in communications spacecraft. Hardware point designs have been completed for a very low drag bearing and a very efficient, compatible motor generator. Using the results of these designs, a tradeoff study compares these flywheels with combinations of NiCd batteries, NiH2 batteries, and conventional low-speed momentum wheels. Section I presents the tradeoff studies for flywheels used for energy storage only, for attitude control only, and for combined energy storage and attitude control. The results show that such wheels look excellent for attitude control alone (as high-speed, high-reliability momentum wheels) and attractive for combined power and attitude control, but not much better than NiH2 for power alone. GRA

N79-15146# Naval Research Lab., Washington, D. C.
THE ORBIT DETERMINATION OF SOLRAD 11
Robert R. Dasenbrock Aug. 1978 125 p refs
(AD-A060743; AD-E000222; NRL-MR-3809) Avail: NTIS HC A06/MF A01 CSCL 22/2

The orbit determination scheme used for the Navy's SOLRAD HI satellite is discussed in detail. A standard batch and sequential orbit determination method is described. Each program used in the data reduction scheme is discussed and a guide to its operation is presented. Results from the early portion of the mission are included. These include the initial raw ranges and resulting orbits. Author (GRA)

N79-15147# Naval Research Lab., Washington, D. C. Systems Research Branch.
SATELLITE BREAKUPS. SURVEY OF A DYNAMICAL THEORY Final Report
William B. Heard Jul. 1978 61 p refs
(RR0140241)
(AD-A060742; AD-E000208; NRL-MR-3802) Avail: NTIS HC A04/MF A01 CSCL 22/3

A general theory is developed for the dynamics of fragments resulting from the breakup of an artificial satellite or other celestial body. The particle ensemble is modeled as a continuum in phase space and the behaviour of the ensemble, as opposed to the behaviour of individual particles, is investigated. The solutions of four central problems are discussed. The problems are the direct problem (prediction of the evolution of the ensemble from the initial conditions), the continuous source problem (direct problem for a point source active over an interval of time), the asymptotic problem (to find the state of the ensemble in the limit as t goes to infinity, and the inverse problem (deduction of the initial conditions from the ensemble structure at a later time). Author (GRA)

N79-15148# Weapons Systems Research Lab., Adelaide (Australia).

THE AERODYNAMIC DESIGN OF A ROCKET TEST VEHICLE FOR PHASE 2 OF THE AFSTAMS TASK
F. G. Burger Apr. 1978 23 p refs
(AD-A060805; WSRL-0004-TR) Avail: NTIS HC A02/MF A01 CSCL 19/7

Phase 2 of the AFSTAMS task required the practical demonstration of the falling sphere method of wind determination using a rigid 120 mm diameter passive sphere. This report describes the aerodynamic design of the free flight rocket test vehicle used to carry this sphere to approximately 20 km altitude. Author (GRA)

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

No abstracts in this category.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications.*

No abstracts in this category.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support.* For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics.*

N79-15149*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
JUPITER PROBE CHARGING STUDY
Carolyn K. Purvis Jan. 1979 38 p refs
(NASA-TP-1263; E-9167) Avail: NTIS HC A03/MF A01 CSCL 22B

A model to predict spacecraft charging effects in the Jovian magnetosphere was developed for the preliminary design of a Jupiter probe. Charging calculations made with this model are presented and discussed. Differential potentials between interior and exterior surfaces and between sunlit and dark exterior surfaces are predicted to be in the kilovolt range. Author

N79-15150*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SPACE ENVIRONMENTAL INTERACTIONS WITH SPACECRAFT SURFACES
John N. Stevens 1979 23 p refs Presented at 17th Aerospace Sci. Meeting, New Orleans, La., 15-17 Jan. 1979 Sponsored by AIAA
(NASA-TM-79016; E-9805) Avail: NTIS HC A02/MF A01 CSCL 22B

Environmental interactions are defined as the response of spacecraft surfaces to the charged-particle environment. These interactions are divided into two broad categories: spacecraft passive, in which the environment acts on the surfaces and spacecraft active, in which the spacecraft or a system on the spacecraft causes the interaction. The principal spacecraft passive interaction of concern is the spacecraft charging phenomenon. The spacecraft active category introduces the concept of interactions with the thermal plasma environment and Earth's magnetic fields, which are important at all altitudes and must be considered the designs of proposed large space structures and space power systems. The status of the spacecraft charging investigations is reviewed along with the spacecraft active interactions. J.M.S.

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography.*

No abstracts in this category.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N79-15151*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LOW THRUST MONOPROPELLANT ENGINE Patent Application
John David Kuenzly, inventor (to NASA) (TRW, Redondo Beach, Calif.) 20 Dec. 1978 13 p
(NASA-Case-GSC-12194-2; US-Patent-Appl-SN-971474) Avail: NTIS HC A02/MF A01 CSCL 21H

A low power thermal decomposition type monopropellant thruster is described which may operate in both the pulsing or steady-state modes at duty cycles representative of attitude and velocity control requirements for long-life, earth orbiting satellites. The device includes a conventional body and nozzle configuration with generally opposed injector tubes and a heater-screen pack configuration having a platinum screen and a refractory metal and oxide heater. Carbonaceous, low freezing point propellants can be used. NASA

N79-15152*# Colorado State Univ., Fort Collins. Dept. of Mechanical Engineering.
PREDICTION OF PLASMA PROPERTIES IN MERCURY ION THRUSTERS
Glen Longhurst Dec. 1978 118 p refs
(Grant NGR-06-002-112)
(NASA-CR-159448) Avail: NTIS HC A06/MF A01 CSCL 21C

A simplified theoretical model was developed which obtains to first order the plasma properties in the discharge chamber of a mercury ion thruster from basic thruster design and controllable operating parameters. The basic operation and design of ion thrusters is discussed, and the important processes which influence the plasma properties are described in terms of the design and control parameters. The conservation for mass, charge and energy were applied to the ion production region, which was defined as the region of the discharge chamber having as its outer boundary the surface of revolution of the innermost field line to intersect the anode. Mass conservation and the equations describing the various processes involved with mass addition and removal from the ion production region are satisfied by a

Maxwellian electron density spatial distribution in that region.
B.B.

N79-15153*# TRW Defense and Space Systems Group, Redondo Beach, Calif.
ION PROPULSION COST EFFECTIVITY Final Report, 29 Mar. 1978 - 1 Dec. 1978
S. Zafran and J. J. Biess Dec. 1978 88 p refs
(Contract NAS5-23453)
(NASA-CR-159902; TRW-33590-8007-RU-00) Avail: NTIS HC A05/MF A01 CSCL 21C

Ion propulsion modules employing 8-cm thrusters and 30-cm thrusters were studied for Multimission Modular Spacecraft (MMS) applications. Recurring and nonrecurring cost elements were generated for these modules. As a result, ion propulsion cost drivers were identified to be Shuttle charges, solar array, power processing, and thruster costs. Cost effective design approaches included short length module configurations, array power sharing, operation at reduced thruster input power, simplified power processing units, and power processor output switching. The MMS mission model employed indicated that nonrecurring costs have to be shared with other programs unless the mission model grows. Extended performance missions exhibited the greatest benefits when compared with monopropellant hydrazine propulsion.
Author

N79-15154# TRW Defense and Space Systems Group, Redondo Beach, Calif.
PULSED PLASMA ACCELERATION IN STRONG BIAS MAGNETIC FIELDS FOR ELECTRIC PROPULSION APPLICATION Final Report, 1 Jun. 1976 - 31 May 1978
C. L. Dailey and R. H. Lovberg 31 Jul. 1978 47 p refs
(Contract F44620-76-C-0107)
(AD-A060457; AFOSR-78-1408TR) Avail: NTIS HC A03/MF A01 CSCL 21/3

It is shown that ohmic efficiency is limited to 50% for self-field quasi-steady plasma acceleration and for impulsive acceleration in small scale devices. This limit also applies when a constant bias field is added to the self-field but it can be removed by using a bias field that decreases in the acceleration direction. Tests were conducted with a bias field thruster in an attempt to demonstrate increased efficiency. It consisted of a V-shaped channel placed between pole pieces of a permanent magnet having the same divergence angle as the channel; electrodes were located in the upper and lower surfaces of the channel. Operation was quasi-steady for a current discharge period of 800 microseconds. Gas injection was continuous and was done in two ways - in one mode it was introduced through hollow electrodes, in the other it entered the channel through a narrow slit. In the final version tested the channel was made of alumina and tungsten electrodes were used. Impulse enhancement due to the bias field was determined by suspending the magnet from piano wires and measuring its deflection when the thruster was fired. For argon injection through the electrodes, the current was carried down-stream from the magnet in the usual self-field discharge mode and no magnet deflection occurred. For axial injection of argon a large magnet deflection occurred. This was found to be due to current carried on the sidewalls which was stabilized by the sidewalls and which produced severe ablation of the alumina. When a mixture of hydrogen and nitrogen was substituted for argon, no magnet deflection occurred. GRA

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N79-15155*# Virginia Polytechnic Inst. and State Univ., Blacksburg.
SYNTHESIS OF AROMATIC SECONDARY DIAMINES Final Report
James F. Wolfe, Thomas D. Greenwood, and Richard A. Kahley [1979] 34 p refs Paper presented in part at the 28th Southeastern Regional Meeting of the Am. Chem. Soc., Gatlinburg, Tenn., Oct. 1976
(Grant NsG-1064)
(NASA-CR-157963) Avail: NTIS HC A03/MF A01 CSCL 07A

A series of N-methyl substituted aromatic polyamides derived from the secondary aromatic diamines, 4,4'-bis(methylamino) diphenylmethane, 3,3'-bis(methylamino) diphenylmethane, 4,4'-bis (methylamino)benzophenone or 3,3'-bis(methylamino) benzophenone and isophthaloyl dichloride, terphthaloyl dichloride or 3,3'diphenylmethane dicarboxylic acid dichloride was prepared by high temperature solution polymerization in s-tetrachloroethane. Compared to analogous unsubstituted and partially N-methylated aromatic polyamides, the full N-methylated polyamides exhibited significantly lower glass transition temperatures, reduced crystallinity, improved thermal stability and good solubility in chlorinated solvents.
Author

24 COMPOSITE MATERIALS

Includes laminates.

N79-15156# Materials Sciences Corp., Blue Bell, Pa.
SHEAR CORRECTION FACTORS FOR LAMINATED PLATES
Sailendra N. Chatterjee and Satish V. Kulkarni (Calif. Univ., Livermore. Lawrence Livermore Lab.) 15 Dec. 1978 38 p refs Backup document for AIAA Synoptic scheduled for publication in the AIAA Journal in April 1979
(Contract F44620-76-C-0080)
Avail: NTIS HC A03/MF A01

Cut-off frequencies for propagation of thickness shear waves obtained from laminated plate theory are matched with exact elasticity solution to calculate shear correction factors of several classes of laminated plates. A technique for estimating the coupling shear stiffness from mode shapes in the elasticity solution is also suggested. General trends in results are studied and solutions are compared with those obtained by the use of static energy formulation as well as other refined plate theories. In laminates, where significant degree of homogeneity is not achieved by proper stacking, appropriate correction factors should be used for calculating static or dynamic plate response.
Author

N79-15157*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DYNAMIC MECHANICAL ANALYSIS OF FIBER REINFORCED COMPOSITES
Katherine E. Reed 1979 20 p refs Presented at 34th Ann. Conf. of Reinforced Plastics/Composites of the Inst. of the Soc. of the Plastics Industry, Inc., New Orleans, La., 29 Jan. - 2 Feb. 1979
(NASA-TM-79033; E-9831) Avail: NTIS HC A02/MF A01 CSCL 11D

Dynamic mechanical and thermal properties were determined for unidirectional epoxy/glass composites at various fiber orientation angles. Resonant frequency and relative logarithmic decrement were measured as functions of temperature. In low angle and longitudinal specimens a transition was observed above the resin glass transition temperature which was manifested mechanically as an additional damping peak and thermally as a change in the coefficient of thermal expansion. The new transition was attributed to a heterogeneous resin matrix induced by the fiber. The temperature span of the glass-rubber relaxation was found to broaden with decreasing orientation angle, reflecting the growth of fiber contribution and exhibiting behavior similar to that of Young's modulus. The change in resonant frequency through the glass transition was greatest for samples of intermediate fiber angle, demonstrating behavior similar to that of the longitudinal shear modulus.
Author

N79-15158# Connecticut Univ., Storrs. Inst. of Materials Science.
WEAR OF HOMOGENEOUS AND COMPOSITE MATERIALS UNDER CONDITIONS OF REPEATED NORMAL AND SLIDING IMPACT Interim Scientific Report, 8 Jun. 1977 - 7 Jul. 1978
Stephen L. Rice and Roman Solecki 1978 67 p refs
(Grant AF-AFOSR-3087-76; AF Proj. 2307)

(AD-A060362; AFOSR-78-1402TR) Avail: NTIS HC A04/MF A01 CSCL 11/4

This report describes experimental and analytical investigations in the area of wear of materials due to repeated impact loading. A reciprocating impact wear test apparatus is utilized to provide controlled, repetitive impacts between a material specimen and a counterface. The impulsive loading may be purely normal or a condition of relative sliding may be introduced during the impact event. A wide variety of materials has been investigated in both normal and alising impact modes. These include polymers, composites, and several materials. The wear behavior of these materials is investigated as a function of peak impulsive load, relative sliding velocity, and number of impact load cycles. Weight loss and/or surface profile data are obtained as a function of these parameters. Scanning electron microscope studies of the wear surface and of sub-surface sections suggest that delamination is the operative mechanism for some materials but not for others. Analytical investigations are directed toward determination of the states of stress in material specimens undergoing controlled, repetitive impact. Results are derived from the theory of elasticity by application of the Papkovich-Neuber solution combined with the double, finite Fourier transformation. Correlations between sub-surface stress levels and wear debris formation are sought.
Author (GRA)

N79-15159# Rockwell International Corp., Los Angeles, Calif.
THERMONUCLEAR EFFECTS ON SANDWICH-TYPE STRUCTURES Final Report, 1 Apr. - 30 Nov. 1977
Craig Sparling and John Schibler 1 Dec. 1977 47 p
(Contract DNA001-77-C-0092)
(AD-A059919; AD-E300339) Avail: NTIS HC A03/MF A01 CSCL 13/13

The presence of internal cell pressure during thermal nuclear pulse exposure in honeycomb sandwich structures was demonstrated. The source of this cell pressure was shown to be a combination of component outgassing, and the effects of heating a sealed gas (Boyle's law). Cell pressure tests were run at 10 to 50 cal/cm.
Author

N79-15160# Delaware Univ., Newark. Dept. of Mechanical and Aerospace Engineering.
THE ANALYSIS AND DESIGN OF COMPOSITE MATERIAL BONDED JOINTS
W. James Renton, Donald L. Flaggs, and Jack R. Vinson Jul. 1978 70 p refs
(Grant AF-AFOSR-2739-74; AF Proj. 2307)
(AD-A060624; MAE-TR-215; IR-3343; AFOSR-78-1371TR) Avail: NTIS HC A04/MF A01 CSCL 13/5

Recent experiments have shown that significant improvements can be made in the structural efficiency of single lap joints through several modifications. Tests have been conducted in which the adherends were linearly tapered from full panel thickness to practically zero thickness over the length of the bondline in the load direction. Further, tests were conducted to examine the effects of introducing small grooves on the adhesive side of the adherends, perpendicular to the load direction. Similarly, grooves only over the thicker half of the tapered adherend were investigated, because these grooves do introduce stress concentrations. In each case, significant improvements in joint efficiency were made under either static or fatigue loadings. Additionally, specific observations are made pertaining to the residual strain effect due to joint fabrication on the fatigue life of strain effect due to joint fabrication on the fatigue life of the joint. Second, studies were made on the effects of using hybrid adherends and their effect on joint efficiency.
GRA

N79-15161# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
FATIGUE BEHAVIOR AND LIFE PREDICTION OF COMPOSITE LAMINATES Final Report, 1 Oct. 1977 - 31 Jan. 1978
H. Thomas Hahn Apr. 1978 70 p refs
(AF Proj. 2419; AF Proj. 2319)
(AD-A060548; AFML-TR-78-43) Avail: NTIS HC A04/MF A01 CSCL 11/4

This report presents a survey of some of the available data on the effects of fatigue in composite laminates. Both static and fatigue behaviors of unidirectional laminae are discussed in terms of the static failure and fatigue limit strains of the constituents as well as of the loading conditions. Subcritical failure modes in multidirectional laminates are delineated and correlated with the material responses such as temperature increase, modulus change, and fatigue notch insensitivity. Also included are the effects of test frequency and compression. Methods of predicting the fatigue strengths of off-axis laminae and of angle-ply laminates are summarized. Finally, two statistical life prediction models are discussed using the material 'age'.
Author (GRA)

N79-15162# Purdue Univ., Lafayette, Ind. Properties Research Lab.
THERMOPHYSICAL PROPERTIES OF POCO GRAPHITE Interim Report
R. E. Taylor and H. Groot Jul. 1978 33 p refs
(Grant AF-AFOSR-3280-77)
(AD-A060419; PRL-153; AFOSR-78-1375TR) Avail: NTIS HC A03/MF A01 CSCL 11/7

The thermal conductivity, specific heat, and electrical resistivity of two samples of POCO AXM 5Q graphite obtained from NBS were measured. These results, combined with previous results for thermal expansion and high temperature specific heat were used to compute thermal diffusivity values from 400 to 2400K The computed diffusivity values agreed well with measured values. The electrical resistivity of the two samples differed significantly from each other and also varied along the length of the rods. Differences in thermal conductivity values between the two samples were directly related to difference in resistivity. In general the results of other researchers could be brought into agreement with the present results, based on differences in resistivity (and density). Consequently it was possible to generate curves of electrical resistivity, thermal conductivity, specific heat and thermal diffusivity of POCO AXM 5Q graphite from 400 to 2400K. There is an electronic contribution to the thermal conductivity. This contribution is less than a few percent at 400K but increases to at least 15% at 2400K.
Author (GRA)

N79-15163# Southern Methodist Univ., Dallas, Tex. Dept. of Civil and Mechanical Engineering.
MECHANICS OF COMPOSITE MATERIALS WITH DIFFERENT MODULI IN TENSION AND COMPRESSION Final Scientific Report, Jun. 1973 - May 1978
Robert M. Jones Jul. 1978 129 p refs
(Grant AF-AFOSR-2532-73; AF Proj. 2307)
(AD-A060416; AFOSR-78-1400TR) Avail: NTIS HC A07/MF A01 CSCL 11/4

Composite materials have been used for several years in thermal protection systems such as reentry vehicle nosetips and heatshields as well as in more conventional aerospace structures such as laminated wings and stabilizers in the latest aircraft. Many composite materials, e.g., ATJ-S graphite, carbon-carbon, and graphite-epoxy, exhibit different strength and stiffness behavior in tension and compression. The moduli differences range from 20% for ATJ-S graphite to between 100% and 400% for carbon-carbon. The principal objective of this research is to model the behavior of solid bodies with different elastic moduli in tension and compression as well as the behavior of laminated plates and shells that have different elastic moduli in tension and compression and lamination asymmetries. The results of this work are coordinated with research sponsored by the Air Force Materials Laboratory on nonlinear stress-strain behavior of reentry vehicle materials. This report is a summary of work done during the last five years.
Author (GRA)

N79-15164# Army Armament Research and Development Command, Aberdeen Proving Ground, Md. Large Caliber Weapon Systems Lab.
THE DETERMINATION OF CELLULOSE CRYSTALLINITY
Arthur J. Bracuti Aug. 1978 27 p refs
(AD-A060807; AD-E400187) Avail: NTIS HC A03/MF A01 CSCL 19/1

This report describes the initial phase of a study to determine the cause of button formation during nitration of sulfate pulp. Three possible causes are presented: (1) Xyland and mannan content; (2) Cellulose II content; and, (3) Amorphous cellulose. A method is described to measure the cellulose crystallinity or conversely the amorphous content. Recommendations are made

to revise procurement specifications for wood pulp to minimize xylan and mannan content, to investigate the effect of Cellulose II upon nitration, and to study the effect crystallinity has upon nitration. Author (GRA)

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*

N79-15165# Tohoku Univ., Sendai (Japan). Inst. of High Speed Mechanics.

SEPARATION FACTORS FOR THE UF6 ISOTOPES ACCELERATED BY HELIUM EXPANDING SPHERICALLY INTO A VACUUM

Kenichi Nanbu 5 Dec. 1978 27 p refs Backup document for AIAA Synoptic scheduled for publication in Journal of Energy in Mar.-Apr. issue, 1979

Avail: NTIS HC A03/MF A01

A spherical source flow of a ternary gas mixture of U235F6, U238F6 and He is analyzed by using the recently introduced multifluids thirteen moment equations. A matter of primary concern is the extent of the velocity-slip between two heavy isotopic species. Because of a singularity in the thirteen moment equations, it is inevitable that an upstream boundary condition of complete equilibrium is set at a certain radius greater than the sonic radius. Therefore, the obtained values of the separation factor are no more than the lowest estimates. It is shown that the separation factor becomes maximum at a certain Knudsen number. The maximum separation factor depends upon the radius/sonic radius or the corresponding Mach number. G.Y.

N79-15166*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

APPLICATION OF THE RELATIVE ENERGY RELEASE CRITERIA TO ENCLOSURE FIRE TESTING

E. John Roschke and Clifford D. Coulbert 1 Jan. 1979 74 p refs

(Contract NAS7-100)

(NASA-CR-158074; JPL-Pub-78-86) Avail: NTIS HC A04/MF A01 CSCL 21B

The five relative energy release criteria (RERC) which are a first step towards formulating a unified concept that can be applied to the development of fires in enclosures, place upper bounds on the rate and amount of energy released during a fire. They are independent, calculated readily, and may be applied generally to any enclosure regardless of size. They are useful in pretest planning and for interpreting experimental data. Data from several specific fire test programs were examined to evaluate the potential use of RERC to provide test planning guidelines. The RERC were compared with experimental data obtained in full-scale enclosures. These results confirm that in general the RERC do identify the proper limiting constraints on enclosure fire development and determine the bounds of the fire development envelope. Plotting actual fire data against the RERC reveals new valid insights into fire behavior and reveals the controlling constraints in fire development. The RERC were calculated and plotted for several descrpitions of full-scale fires in various aircraft compartments. A.R.H.

N79-15167*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

ENCLOSURE FIRE HAZARD ANALYSIS USING RELATIVE ENERGY RELEASE CRITERIA

C. D. Coulbert 1 Dec. 1978 39 p refs

(Contract NAS7-100)

(NASA-CR-158075; JPL-Pub-78-51) Avail: NTIS HC A03/MF A01 CSCL 21B

A method for predicting the probable course of fire development in an enclosure is presented. This fire modeling approach uses a graphic plot of five fire development constraints, the relative energy release criteria (RERC), to bound the heat release rates in an enclosure as a function of time. The five RERC are flame spread rate, fuel surface area, ventilation, enclosure volume, and total fuel load. They may be calculated versus time based on the specified or empirical conditions describing the specific enclosure, the fuel type and load, and the ventilation. The calculation of these five criteria, using the common basis of energy release rates versus time, provides a unifying framework for the utilization of available experimental data from all phases of fire development. The plot of these criteria reveals the probable fire development envelope and indicates which fire constraint will be controlling during a criteria time period. Examples of RERC application to fire characterization and control and to hazard analysis are presented along with recommendations for the further development of the concept. Author

N79-15168# Naval Postgraduate School, Monterey, Calif.

A STATISTICAL STUDY OF NOAP DATA M.S. Thesis

Ali Ekmekci Sep. 1978 60 p refs

(AD-A060813) Avail: NTIS HC A04/MF A01 CSCL 14/2

This thesis examines spectrometric oil analysis data in an attempt to determine which of various sources can affect the spectrometer read-out. The analysis of variance is used to a large extent in the study made of operational data. In order to satisfy the normality and independence assumptions of ANOVA, results obtained in a previous study on the same type of data have been used. Some transformations of the data have been made so that the third assumption, homogeneity of variance, can be more nearly satisfied. GRA

N79-15169# California Univ., Berkeley. Dept. of Mechanical Engineering.

INTERACTION OF A PLANE FLAME FRONT WITH THE WAKE OF A CYLINDER Interim Report

I. Namer, Y. Agrawal, R. K. Cheng, F. Robben, R. Schefer, and L. Talbot Oct. 1977 40 p refs

(Contract F44628-76-C-0083; AF Proj. 2307)

(AD-A060401; UCB/FM-77-3; AFOSR-78-1404TR) Avail: NTIS HC A03/MF A01 CSCL 21/2

A Rayleigh scattering and laser Doppler velocimetry system has been developed for studying the interaction between the vortex street behind a cylinder and a two dimensional plane flame front. Measurements on an open jet methane/air flame stabilized on a heated 0.25 mm platinum wire showed appreciable instabilities in the flame due to the turbulent eddies in the mixing region of the jet. By enclosing the flow in a square channel flame stability was increased. A 3.2 mm diameter cylinder was used to generate a Karman vortex street at a frequency of 22 Hz. Measurements indicated that the flame motion in the wake is small compared to the scale of vortices shed by the cylinder. Furthermore, the flame upstream of the wake region also fluctuated which would indicate that as a portion of the flame fluctuates, it perturbs the entire flow field upstream. GRA

N79-15170# AeroChem Research Labs., Inc., Princeton, N. J.

HIGH-TEMPERATURE FAST-FLOW REACTOR STUDIES OF ELEMENTARY REACTIONS Interim Report

Arthur Fontijn 1978 7 p refs Repr. from High Temp. Metal Halide Chem. (Princeton, N. J.), 1978 p 484-493

(Contract F44620-76-C-0108; AF Proj. 2303)

(AD-A059110; AFOSR-78-1174TR) Avail: NTIS HC A02/MF A01 CSCL 07/4

A unique experimental method is described for providing information on the kinetics of individual elementary reactions of neutral metallic species as a function of temperature. A high-temperature fast-flow reactor (HTFFR) was used to study oxidation reactions of refractory metal atom and metal oxide species from about 300 to 1900 K by a single experimental method, thereby overlapping the temperature domains of traditional near room temperature techniques and flames and shock tubes. The technique, some significant results, and its extension to measurements on chemiluminescent and electronic excitation quenching reactions are briefly reviewed. G.G.

N79-15171# California Univ., Los Angeles. Dept. of Chemistry.

HYDRIDO-COMPLEXES OF RUTHENIUM WITH CARBORANE LIGANDS Interim Report

Edward H. S. Wong and M. Frederick Hawthorne 9 Jun. 1978 26 p refs

(Contract N00014-76-C-0390; NR Proj. 053-608)
(AD-A056808; Contrib-3711; TR-102) Avail: NTIS HC A03/MF A01 CSCL 07/2

The synthesis and characterization of the complexes 2,2-(PPh3)22,2-H2-2,1,7-RuC2B9H11 and 3,3-(PPh3)2-3,3-H2-3,1,2-RuC2B9H11 via the oxidative addition of 7,9- and 7,8-C2H9H12, respectively, to (PPh3)3 RuHCl is described. These complexes are formulated as seven-coordinate formal Ru(IV) compounds. The 2,1,7-isomer was found to reversibly eliminate one molecule of H2 with heating in vacuo to give a five-coordinate d to the 6th power formal Ru(II) complex. Both the 2,1,7- and 3,1,2-isomers readily lose hydrogen in their reaction with HCl and CO to give the corresponding substituted complexes. The pyridine substituted complex 3,3-(PPh3)2-3-H-7-C5H5N-3,1,2RuC2B9H10 was also prepared and characterized. Author

N79-15172# Wisconsin Univ. - Madison. Mathematics Research Center.

BIFURCATION ANALYSIS NEAR A DOUBLE EIGENVALUE OF A MODEL CHEMICAL REACTION

David G. Schaeffer and Martin A. Golubitsky Jun. 1978 54 p refs
(Contract DAAG29-75-C-0024; Grants NSF MCS-77-04148; NSF MCS-77-03655)
(AD-A060721; MRC-TSR-1859) Avail: NTIS HC A04/MF A01 CSCL 07/4

This paper analyzes the steady-state bifurcations from the trivial solution of the reaction-diffusion equations associated to a model chemical reaction, the so-called Brusselator. The present analysis concentrates on the case when the first bifurcation is from a double eigenvalue. The dependence of the bifurcation diagrams on various parameters and perturbations is analyzed. The results of Technical Summary Report No. 1844 (MRC-TSR-1844) are invoked to show that further complications in the model would not lead to new behavior. GRA

N79-15173# Hull Univ. (England). Dept. of Chemistry.

KINETICS OF HYDROGEN-OXYGEN AND HYDROCARBON-OXYGEN REACTIONS Interim Report, 1 Apr. 1977 - 30 Jun. 1978

Robert R. Baldwin and Raymond W. Walker Jun. 1978 18 p refs
(Grant AF-AFOSR-3215-77)
(AD-A060400; AFOSR-78-1373TR) Avail: NTIS HC A02/MF A01 CSCL 07/3

Refinement of the rate constant obtained from studies of the H2-O2 reaction at 500 C has continued. Rate constants for the reactions of H atoms and OH radicals with C2-C5 alkanes have been refined, and Arrhenius parameters obtained. New studies have been made of the addition of 2,2,3,3-tetramethylbutane and 2,2,3-trimethylbutane to slowly reacting mixtures of H2-O2 at 480 C. The mechanism of CO2 formation in propionaldehyde oxidation, and of acetone formation in isobutyraldehyde oxidation at 440 C has been examined. Rate constants have been obtained for the initiation process and for attack of HO2 at the various C-H bonds. The homogeneous decomposition of 2,2,3,3-tetramethylbutane (TMB) in the presence of O2 has been shown to be an excellent source of HO2 radicals, and preliminary rate constants have been obtained for HO2-TMB, and HO2-C2H6 at 440 C. Interpretation of the N2O-H2 reaction continues. Author (GRA)

N79-15174# Materials Research Labs., Ascot Vale (Australia).

THE DETERMINATION OF OZONE CONCENTRATION IN A LABORATORY OZONE CABINET Final Technical Note

J. Hart Feb. 1978 15 p refs
(AD-A057204; MRL-TN-410) Avail: NTIS HC A02/MF A01 CSCL 07/2

Three methods for the determination of ozone concentration in the range normally found in laboratory ozone cabinets were compared. The methods were: (1) potentiometric spray-jet titration; (2) hand-held gas-detector tube; and (3) a chemiluminescence apparatus. Some of the common sources of error were identified and the precautions necessary to obtain reliable results are mentioned. It is shown that the simple hand-held gas detector is capable of producing acceptable results for specification control purposes. Author

N79-15175# Aerospace Corp., El Segundo, Calif.

EXPERIMENTAL MEASUREMENT OF THE RATE OF REACTION O(3P)+H2(v=0) YIELDS OH(v=0)+H AT T=296K Interim Report

G. C. Light Aug. 1978 35 p refs
(Contract F04701-77-C-0078)
(AD-A059447; TR-0078(3970-40)-2) Avail: NTIS HC A03/MF A01 CSCL 07/4

Measurement of the rate of the reaction O(3P)+H2(v = 0) yields OH(v = 0)+H is reported. The result is based on data for the absolute density of OH(v = 0) obtained from laser-induced fluorescence measurements in the (0-0) band of the OH system. The densities of oxygen and nitrogen atoms were varied by changing the density of NO which is consumed in the reaction: N + NO yields O + N2. It was found that k(1)(296 K) = (5.5 plus or minus 2.9) x 1 mil., cc/mole-sec. It was found that the addition of N2 or CO2 effectively suppressed the excitation of H2(v = 1). Measurements of the density of H2(v = 1) were made by VUV absorption in the Lyman band system of H2. All of the reports of low temperature measurements and some recent theoretical calculations for k(1) are discussed. The present result confirms and extends the growing evidence for significant curvature in the low temperature end of an Arrhenius plot of k(1)(T). Author

N79-15176# South Dakota State Univ., Brookings. Water Resources Inst.

PREPARATION AND ANALYSIS OF WATER SEDIMENT AND PLANT SAMPLES FOR METALS Final Report

David C. Hilderbrand May 1978 10 p
(Contract DI-14-34-0001-7087; OWRT Proj. A-057-SDAK(1))
(PB-286123/5; W78-11372) Avail: NTIS HC A02/MF A01 CSCL 02D

Two aspects of analysis of water systems for metals were investigated: Analysis of drinking water supplies for potentially toxic materials with the objective of developing suggested procedures for these elements, and sampling bottom sediments for metal analysis. The three elements studied in detail were chromium, cadmium, and lead. Arsenic was less thoroughly investigated. The recommended methods gave satisfactory results. All procedures studied to obtain a representative bottom sediment sample failed. Poor reproducibility is due to the inhomogeneity of the sample and incomplete dissolution of the metal content of the sample. GRA

N79-15177# New Mexico Energy Inst., Albuquerque.

METHANE PRODUCTION FROM CARBON OXIDES OVER BOROHYDRIDE-REDUCED TRANSITION METALS Final Report

Thomas W. Russell Jan. 1978 40 p refs Sponsored by New Mexico Energy and Minerals Dept. Prepared in cooperation with Eastern New Mexico Univ., Portales
(PB-286385/0; NMEI-76/173) Avail: NTIS HC A03/MF A01 CSCL 07D

The utility of borohydride-reduced transition metals as catalysts was studied for the hydrogenation of carbon oxides to produce synthetic fuels. Work with cobalt, copper, nickel and palladium has resulted in methane production from both carbon oxides, with carbon dioxide being only slightly less productive than carbon monoxide. From the last three metals, methane is the only product formed (besides water). Continuous methanation over nickel has shown no decrease in methane production during a two-week run. Continuous methanation over cobalt in the presence of 10 ppm of sulfur dioxide has shown an increase in methane production during a two-week run. GRA

N79-15178# Lehigh Univ., Bethlehem, Pa. Dept. of Chemical Engineering.

IMPROVING UTILIZATION OF IMMOBILIZED ENZYMES USING FLUIDIZED BED REACTORS Final Report

Marvin Charles and Robert W. Coughlin (Conn. Univ., Stores) Jun. 1978 65 p refs
(Grant NSF AER-72-03546)
(PB-285986/6; NSF/RA-780163) Avail: NTIS HC A04/MF A01 CSCL 07A

The use of fluidized-bed technology for processing with immobilized enzymes was demonstrated and an immobilized-enzyme process for the hydrolysis of lactose in cheese whey

was developed, thereby enhancing the economic value of a cheese-manufacturing by-product. Bench-scale experiments were conducted and a scale-up facility was constructed. An approximate preliminary economic analysis was made of various processing schemes for cheese whey employing enzymatic hydrolysis. The results were in terms of return-on-investment for various case studies of different process configurations. Patents are included. GRA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N79-15179# Naval Research Lab., Washington, D. C.
SURFACE CHEMISTRY OF BALL BEARING STEELS 2
James S. Murday and Elaine G. Shafrin Aug. 1978 100 p (RR0130143)
(AD-A060834; NRL-MR-3850) Avail: NTIS HC A05/MF A01 CSCL 13/9

The lifetime and performance characteristics of ball bearing surfaces and sliding contacts are determined in part by their surface chemistry. This work is in the nature of a survey to identify the important aspects of the various bearing preparation techniques, using newly available analytical tools which are sensitive to the surface layers. Examples of Auger spectroscopic surface analyses will be presented which illustrate the surface compositional changes due to different aspects of specimen preparation: cleaning techniques, specimen handling procedures, and chemical treatment technology. Author (GRA)

N79-15180# Illinois Univ. at Urbana-Champaign, Urbana. Dept. of Metallurgy and Mining Engineering.
PRECIPITATION AND ORDERING IN THE NIOBIUM-HYDROGEN SYSTEM Ph.D. Thesis
Bruce James Makenas Jul. 1978 172 p refs
(Contract N00014-75-C-1012)
(AD-A060004) Avail: NTIS HC A08/MF A01 CSCL 11/6

An experimental study, using transmission electron microscopy techniques was carried out to observe precipitation and ordering phenomena in the niobium-HY/ Nb 1.07 were prepared by improved hydrogen charging methods. Room temperature, hot stage, and cold stage experiments were performed in situ in the electron microscope. The plastic deformation, which accompanies the precipitation and dissolution of hydrides, was observed. Volume constraint, temperature gradients, and impurity traps were shown to have an effect on the nucleation of hydrides. Several low temperature ordered phases (delta, epsilon, and lambda) were studied using electron diffraction. The crystal structures were observed to change with both temperature and composition. The NbH2, delta phase, was also studied and shown to consist of a highly twinned fcc structure. GRA

N79-15181# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Mechanical Engineering, Aeronautical Engineering and Mechanics.
UNIAXIAL VISCOPLASTICITY BASED ON TOTAL STRAIN
M. C. M. Liu and E. Krempl Jul. 1978 39 p refs
(Contract N00014-76-C-0231)
(AD-A060149; RPI-CS-78-4) Avail: NTIS HC A03/MF A01 CSCL 11/6

A previously proposed uniaxial constitutive equation nonlinear in the Cauchy stress and the engineering strain but linear in the stress and strain rates is specialized to an overstress model. Two unknown coefficient functions are determined by extrapolation of room temperature relaxation data on Type 304 stainless steel. The stiff first-order nonlinear differential equations are then numerically integrated for a variety of test histories. GRA

N79-15182# Systems Research Labs., Inc., Dayton, Ohio. Research Applications Div.
PROPERTIES AND MICROSTRUCTURES OF HIGH-TEMPERATURE MATERIALS Final Technical Report, 1 Dec. 1974 - 31 Mar. 1978
M. G. Mendiratta and N. S. Choudhury Aug. 1978 96 p refs
(Contract F33615-75-C-1005; AF Proj. 2306)
(AD-A060386; SRL-3165; AFML-TR-78-112) Avail: NTIS HC A05/MF A01 CSCL 11/2

This final technical report contains information on investigations whose aim was to study specific aspects of properties and microstructures of high-temperature materials. These investigations are: (1) fracture from controlled surface flaws in structural ceramics, (2) fractography of reaction-sintered silicon nitride, (3) oxidation behavior of titanium aluminides, and (4) creep behavior of titanium aluminide and titanium aluminide - 10 wt% Nb. The scientific basis and advantages and disadvantages of the microhardness indentation technique in producing controlled surface flaws and in studying the fracture behavior of structural ceramics are reviewed. The current applications of this technique--including fracture toughness determinations, subcritical-crack-growth measurements, and investigation of mixed-mode fracture--are discussed. An SEM fractography study has been carried out on bend bars of KBI and Norton NC-350 reaction-sintered silicon-nitride ceramics fractured at temperatures ranging from room temperature to 1500 C. The purpose of this study was to examine overall fracture features, identify and analyze the fracture-initiating critical flaws, and correlate these with four-point bend strength. The oxidation behavior of titanium aluminides is reported which includes the effect of temperature upon the oxidation of TiAl-base aluminides, the microstructural characterization of scale morphologies of both TiAl and Ti3Al, and the results of oxidation tests on alloys of TiAl and Ti3Al. GRA

N79-15183# Naval Research Lab., Washington, D. C.
EFFECT OF HEAT TREATMENT ON FATIGUE CRACK PROPAGATION AND DEFORMATION MODE IN ALLOY 718 AT ELEVATED TEMPERATURES Interim Report
H. H. Smith and D. J. Michel Jul. 1978 39 p refs
(RR0221141)
(AD-A060741; AD-E000212; NRL-MR-3810) Avail: NTIS HC A03/MF A01 CSCL 11/6

Alloy 718 is a commercial, wrought nickel-base alloy widely utilized in moderate temperature structural applications and has been proposed for use in advanced nuclear systems. In such applications, Alloy 718 will experience the combined effects of cyclic and static loading and sustained elevated temperatures. However, when used in structures requiring welds, Alloy 718 exhibits reduced weld ductility and strain age cracking when given conventional post-weld duplex age heat treatments. A modified heat treatment has been previously proposed to obviate these problems and thereby improve structural reliability. The effect of conventional and modified heat treatments and combined cyclic and static loading (hold time) on crack propagation and deformation mode in two heats of Alloy 718 plate material was investigated at 427 and 593 C. The fatigue results show that, in general, the resistance of Alloy 718 to crack propagation at these temperatures was not adversely affected by the modified heat treatment and, under most conditions, was found to be improved in comparison with the conventional heat treatment. Scanning electron microscopy (SEM) examination of the fracture surfaces of the fatigue specimens revealed that the failure mode was dependent on test temperature and heat treatment. The material given the conventional heat treatment exhibited transgranular failure modes at both test temperatures. On the other hand, the modified heat treatment produced transgranular fractures at 427 C and intergranular or a mixed failure mode at 593 C. GRA

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N79-15184*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF NITROGEN-CONTAINING PLASMA ON ADHERENCE, FRICTION, AND WEAR OF RADIOFREQUENCY-SPUTTERED TITANIUM CARBIDE COATINGS
William A. Brainard and Donald R. Wheeler Jan. 1979 21 p refs

(NASA-TP-1377; E-9681) Avail: NTIS HC A02/MF A01 CSCL 11D

Friction and wear experiments on 440C steel surfaces that were rf sputtered with titanium carbide when a small percentage of nitrogen was added to the plasma were conducted. Both X-ray photoelectron spectroscopy and X-ray diffraction were used to analyze the resultant coatings. Results indicate that the small partial pressure of nitrogen (approximately 0.5 percent) markedly improves the adherence, friction, and wear properties when compared with coatings applied to sputter-etched surfaces, oxidized surfaces, or in the presence of a small oxygen partial pressure. The improvements are related to the formation of an interface containing a mixture of the nitrides of titanium and iron, which are harder than their corresponding oxides. A.R.H.

N79-15185*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

BOUNDARY LUBRICATION, THERMAL AND OXIDATIVE STABILITY OF A FLUORINATED POLYETHER AND A PERFLUOROPOLYETHER TRIAZINE

William R. Jones, Jr. and Carl E. Snyder, Jr. (AFML, Ohio) 1979 24 p refs Proposed for presentation at Ann. Meeting of the Am. Soc. of Lubrication Engineers, St. Louis, Mo., 30 Apr. - 3 May 1979

(NASA-TM-79064; E-9879) Avail: NTIS HC A02/MF A01 CSCL 11H

Boundary lubricating characteristics, thermal stability, and oxidation-corrosion stability were determined for a fluorinated polyether and a perfluoropolyether triazine. A ball-on-disk apparatus, a tensimeter, and oxidation-corrosion apparatus were used. Results were compared to data for a polyphenyl ether and a C-ether. The polyether and triazine yielded better boundary lubricating characteristics than either the polyphenyl ether or C-ether. The polyphenyl ether had the greatest thermal stability (443 C) while the other fluids had stabilities in the range 389 to 397 C. Oxidation-corrosion results indicated the following order of stabilities: perfluoropolyether trizine greater than polyphenyl ether greater than C-ether greater than fluorinated polyether.

Author

N79-15186*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EFFECT OF THERMAL AGING ON THE TRIBOLOGICAL PROPERTIES OF POLYIMIDE FILMS AND POLYIMIDE-BONDED GRAPHITE FLUORIDE FILMS

Robert L. Fusaro 1979 32 p refs Proposed for presentation at the 34th Ann. Meeting, St. Louis, 30 Apr. - 3 May 1979; Sponsored by the Am. Soc. of Lubrication Engr.

(NASA-TM-79045; E-9179-1) Avail: NTIS HC A03/MF A01 CSCL 07C

Weight loss, adherence, friction and wear of polyimide films and polyimide-bonded graphite fluoride films applied to stainless steel disks and to 304 stainless steel thin foils were studied. The films were exposed at temperatures of 315 D, 345 D, 370 D, or 400 C for 100 hours or more and then evaluated at temperatures of 25 D, 315 D, or 345 C in atmospheres of dry or moist air. Polyimide films were found to be brittle after thermal exposure; but polyimide-bonded graphite fluoride possessed good adherence and gave low friction and wear results. Polyimide-bonded graphite fluoride films appear to be good candidates for solid lubrication applications where long thermal soaks are prevalent. G.G.

N79-15187*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

FLASH-FIRE PROPENSITY AND HEAT-RELEASE RATE STUDIES OF IMPROVED FIRE RESISTANT MATERIALS

Larry L. Fewell Dec. 1978 46 p

(NASA-TM-78550; A-7548) Avail: NTIS HC A03/MF A01 CSCL 11E

Twenty-six improved fire resistant materials were tested for flash-fire propensity and heat release rate properties. The tests were conducted to obtain a descriptive index based on the production of ignitable gases during the thermal degradation process and on the response of the materials under a specific heat load. Author

N79-15188# Royal Aircraft Establishment, Farnborough (England).

THE CORROSIVE ACTIVITY OF RUBBERS AND COMPOUNDS BASED ON THEM

A. K. Smolich and A. L. Labutin Jul. 1978 14 p refs Transl. into ENGLISH from Kauchuk Rezina (USSR), v. 5, 1977 p 19-24

(RAE-Lib-Trans-1966; BR66075) Avail: NTIS HC A02/MF A01

The corrosion of metals in contact with rubber, its causes, assessment and means of combating it are reviewed. Metals can be attacked by, (1) impurities such as catalyst residues from polymerisation; (2) the products of chemical breakdown of the polymer during processing, subsequent storage, or in service; or (3) compounding ingredients, antioxidants, and fillers. Tests to predict 'in service' behavior are usually made at high humidity and elevated temperatures. Various methods are used to assess the results. Means of reducing corrosion include purification of the base polymer, the inclusion of acid acceptors in the vulcanisate, post cure to remove harmful volatiles, applying a protective coating to the metal and control of environmental conditions. A.R.H.

N79-15189# Army Armament Research and Development Command, Dover, N. J. Large Caliber Weapon Systems Lab.

ACTIVATED GAS PLASMA SURFACE TREATMENT OF NEWER STRUCTURAL PLASTICS FOR ADHESIVE BONDING

Marie C. Ross Aug. 1978 35 p refs

(AD-A060811; AD-E400200) Avail: NTIS HC A03/MF A01 CSCL 13/8

A limited investigation was conducted on adhesive bonding of eight of the newer structural plastics. The plastics were: Valox, an aromatic polyester; PES 200P, a polyethersulfone; Astrel, a polyarylsulfone; Ryton, a polyphenlene sulfide; Halar, an E-CTFE fluoropolymer, and three different polyamides, nylons 11, 6/12, and 12. Activated gas plasma (helium and oxygen) treatment was used in treating the plastics. Significant improvements in shear strength values over previous treatments (sanding, etching, flame treating, solvent wiping) were obtained for Valox, Astrel, Ryton, Halar, and nylon 6/12. Only two plastics, Halar and Valox, bonded with EC-2214, a 121 C (250 deg) curing adhesive, showed significant increases in bond strength values after gas plasma treatment when compared to the room temperature curing Epon 828/Versamid 140 adhesive bonded specimens. Author (GRA)

N79-15190# Dayton Univ. Research Inst., Ohio.

PREDICTING GLASS TRANSITION TEMPERATURES (TG) OF POLYMERS FROM THEIR MOLECULAR STRUCTURE. PART 1: INDIVIDUAL ATOM CONTRIBUTIONS Final Technical Report, Dec. 1976 - Dec. 1977

D. R. Wiff and I. J. Goldfarb Apr. 1978 67 p refs

(Contract F33615-75-C-5095; AF Proj. 2419)

(AD-A060361; AFML-TR-78-25-Pt-1) Avail: NTIS HC A04/MF A01 CSCL 07/3

The present investigation is an extension of the method of Askadskii and Slonimskii to predict the glass transition temperature of amorphous polymers. The glassy volume of each polymer structure at a reference temperature is calculated using the Van der Waals radii of the individual atoms, the bonding distances, and the procedure of Kitaigorodskii. The volume of the repeat unit at T sub g is approximated as the sum of the product of a weighting factor and a determined incremental volume contribution. Results using the L sub 1 error approximation and representing over 175 chemically or sterically different polymer structures are presented. Author (GRA)

N79-15191# Martin Marietta Aerospace, Orlando, Fla.

LOW COST PLASTIC ACTUATOR PROCESS DEVELOPMENT Final Report, Apr. 1976 - Mar. 1977

James R. Hickey Apr. 1977 36 p refs

(Contract F33615-76-C-3086; AF Proj. 1987)

(AD-A060898; OR-14445; AFFDL-TR-77-19) Avail: NTIS HC A03/MF A01 CSCL 13/7

The feasibility of a hydraulic actuator made principally of molded plastic was demonstrated under Air Force contract F33615-74-C-3013. The present contract, F33615-76-C-3086, concerns the investigation of various processes and molding

techniques to improve the yield of parts capable of withstanding the hydraulic pressures necessary for actuator operation.
Author (GRA)

N79-15192# Massachusetts Univ., Amherst. Materials Research Lab.
SOLID STATE COEXTRUSION OF HIGH DENSITY POLYETHYLENE. 1: EFFECTS OF GEOMETRIC FACTORS
Tetsuo Kanamoto, Anagnostius E. Zachariades, and Roger S. Porter 16 Jan. 1978 30 p refs 2 Vol.
(Contract N00014-75-C-0686; NR Proj. 356-584)
(AD-A060801; TR-10) Avail: NTIS HC A03/MF A01 CSCL 13/8

The effects of geometry and volume fraction on the solid (crystalline) state coextrusion of two concentric different high density polyethylenes (HDPE) having weight average molecular weights (Mw) 59,000 and 200,000 have been studied. The extrusion rate increased nonlinearly with the volume fraction of the low Mw component. The rate was faster when the low/Mw component was the core rather than the sheath in the initial billet. Thus the slow extrusion rate of high Mw HDPE alone was increased up to ten times by coextrusion with a small fraction of the low Mw HDPE component in the middle of the high Mw HDPE billet. Generally, the deformation flow profile changed gradually from a parabolic to a W shape pattern as the volume fraction of the high Mw component increased. However, the geometric arrangement of the two different Mw components in the initial billet had also a pronounced effect on deformation. The deformation patterns showed that upon coextrusion the low and high Mw HDPE's were extruded at the same rate and extrusion draw ratio. Geometry had no substantial effects on the tensile modulus and strength of the extrudates; i.e., they increased linearly with volume fraction of the high Mw HDPE. Author (GRA)

N79-15193# Massachusetts Univ., Amherst. Materials Research Lab.
SOLID STATE COEXTRUSION OF HIGH DENSITY POLYETHYLENE. 2: EFFECT OF MOLECULAR WEIGHT AND MOLECULAR WEIGHT DISTRIBUTION
Anagnostis E. Zachariades, Tetsuo Kanamoto, and Roger S. Porter 16 Oct. 1978 34 p refs 2 Vol.
(Contract N00014-75-C-0686; NR Proj. 356-584)
(AD-A060802; TR-11) Avail: NTIS HC A03/MF A01 CSCL 13/8

The recently developed technique of solid state coextrusion for ultradrawing semicrystalline thermoplastics has been applied in the preparation of self-reinforced high density polyethylene extrudates. The extrudates consist of definite core and sheath phases composed of different molecular weights (Mw) in the range of 60,000 - 250,000 and different molecular weight distributions (Mw/Mn = 0.3 - 20). Cocylindrical billets of two different phases were prepared for extrusion by inserting a polyethylene rod within a tubular billet of a different high density polyethylene followed by melting the two phases to obtain bonding between them. The billet was then split longitudinally to increase extrusion speed followed by extrusion at 120 C, 0.23 GPa and extrusion draw ratio 25. Thus it was possible to produce extrudates of high tensile modulus (45 GPa) and strength (0.55 GPa) at a rate near 0.7 cm./min. In general, the tensile properties of the extrudates increased with average molecular weight and were insensitive to the molecular weight distribution of the two phases. Author (GRA)

N79-15194# Rutgers - The State Univ., Piscataway, N. J. College of Engineering.
HIGH PRESSURE CRYSTALLIZATION OF POLY (VINYLIDENE FLUORIDE)
J. I. Scheinbeim, C. Nakafuku, B. A. Newman, and K. D. Pae 9 Oct. 1978 37 p refs
(Contract N00014-75-C-0540)
(AD-A060649; TR-12) Avail: NTIS HC A03/MF A01 CSCL 11/9

The pressure dependence of the melting and crystallization temperatures of poly(vinylidene fluoride) is determined by high pressure differential thermal analysis (DTA). These results are used in the investigation of the polymorphic crystal form obtained by pressure quenching molten poly(vinylidene fluoride): The resulting crystal form depends on both the initial and final pressures. The pressure quenching experiments were performed in a high pressure piston-cylinder system and in a high pressure DTA system; a comparison is made of the results obtained by both methods. Author (GRA)

N79-15195# Lehigh Univ., Bethlehem, Pa. Materials Research Center.
INVESTIGATIVE STUDY ON THE FEASIBILITY OF UTILIZING FLUORINATED ETHYLENE PROPYLENE ELASTOMERS AS PROTECTIVE MASK FACEBLANK MATERIALS Final Report, Jun. 1976 - Jan. 1978
L. H. Sperling and D. A. Thomas May 1978 43 p refs
(Contract DAAA15-76-C-0126; DA Proj. 1W7-62710-A-095)
(AD-A060672; AD-E410075; ARCSL-CR-78052) Avail: NTIS HC A03/MF A01 CSCL 11/10

This paper demonstrates the feasibility of obtaining a tough, transparent crosslinked fluorocarbon elastomer with reduced creep. The linear material exhibits creep and tackiness but is relatively clear. Existing vulcanizing recipes yield opaque, crosslinked materials. Polymerization is accomplished via high energy radiation. The linear fluorocarbon is physically bound up with the crosslinked network formed by the polymerized monomer, producing a semiinterpenetrating polymer network (IPN) of the second kind. The optimum conditions for the synthesis of a fluorocarbon elastomer with the desired properties, appear to be a dose level of 5.0 to 7.5 Mrads of beta radiation and a trimethylolpropane trimethacrylate (TMPTM concentration of 3-5%), based on experiment. Author (GRA)

N79-15196# Rockwell International Corp., Thousand Oaks, Calif. Science Center.
NONDESTRUCTIVE FAILURE PREDICTION IN CERAMICS Final Report, 1 Mar. 1976 - 28 Feb. 1978
A. G. Evans Sep. 1978 44 p refs
(Contract N00014-76-C-0624)
(AD-A060785; SC5064.3FR) Avail: NTIS HC A03/MF A01 CSCL 11/2

Techniques for nondestructive failure prediction in ceramics are examined in the context of a probabilistic framework for obtaining failure and rejection probabilities. The ultrasoinc method appears to have the greatest short-term potential for achieving acceptable failure probabilities, without the excessive rejection of satisfactory components. Author (GRA)

N79-15197# Akron Univ., Ohio. Inst. of Polymer Science.
THE ROLE OF CHEMICAL BONDING IN ADHESION
A. N. Gent and P. Dreyfuss Oct. 1978 37 p refs
(Contract N00014-76-C-0408; NR Proj. 092-555)
(AD-A060730; ATR-3) Avail: NTIS HC A03/MF A01 CSCL 13/8

Studies of the effect of chemical bonding on the measured joint strength of bonds formed between polymers and rigid substrates have been carried out. Various treatments have been applied to glass surfaces before bonding to polymeric overlayers. These treatments have included reaction of glass with mono and trialkoxysilanes, urethanes, silanated polybutadienes, and polysiloxane layers. Effects on the resulting joint strength varied from an insignificant level to a thirtyfold increase. Comparisons of various results of joints between glass and a polybutadiene overlayer, summarized in this report, suggest that a transition layer such as a polysiloxane layer must be introduced before positive effects of chemical bonding are obtained. When this transition layer is present, the measured strength of the joint is found to increase as the number of chemical bonds increases. In experiments involving the bonding together of two identical polybutadiene layers, the joint strength was found to increase in direct proportion to the number of assumed interfacial chemical bonds. Author (GRA)

N79-15198# Addis Translations International, Portola Valley, Calif.
CONTRIBUTION TO THE NONDESTRUCTIVE TESTING OF FIRST IRREVERSIBLE PROCESSES IN GLASS-FIBER-REINFORCED PLASTICS
K. P. Buhmann Oct. 1977 204 p refs Transl. into ENGLISH from a Doctoral Dissertation from Technical Univ. Hanover (West Germany), 1975 189 p Prepared for California Univ., Livermore.

Lawrence Livermore Lab.
(UCRL-Trans-11257) Avail: NTIS HC A10/MF A01

A material-specific strain-related event threshold for uniaxially and biaxially loaded glass-fiber-reinforced plastics in deformation ranges below the permissible strains can be determined by means of several nondestructive measurement methods. Sound emission analyses display the highest indication sensitivity in comparison to all other nondestructive measurement methods. DOE

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N79-15199*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HIGH FREEZING POINT FUELS USED FOR AVIATION TURBINE ENGINES
Robert Friedman 1979 14 p refs To be presented at the 24th Ann. Intern. Gas Turbine Conf., San Diego, Calif., 11-15 Mar. 1979, sponsored by ASME
(NASA-TM-79015; E-9804) Avail: NTIS HC A02/MF A01 CSCL 21D

Broadened-specification aviation fuels could be produced from a greater fraction of crude source material with improvements in fuel supply and price. These fuels, particularly those with increased final boiling temperatures, would have higher freezing temperatures than current aviation turbine fuels. For the small but significant fraction of commercial flights where low fuel temperatures make higher freezing-point fuel use unacceptable, adaptations to the fuel or fuel system may be made to accomodate this fuel. Several techniques are discussed. Fuel heating is the most promising concept. One simple design uses existing heat rejection from the fuel-lubricating oil cooler, another uses an engine-driven generator for electrical heating. A.R.H.

N79-15200*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
STORAGE OF SOLID PROPELLANTS IN A DRY ENVIRONMENT
D. E. Udlock 15 Nov. 1978 21 p refs
(Contract NAS7-100)
(NASA-CR-158073; JPL-Pub-78-99) Avail: NTIS HC A02/MF A01 CSCL 21I

Storage of solid propellants in either a dry or a vacuum environment causes a significantly greater increase in the propellants' modulus and maximum tensile strength than does ambient storage. It is postulated that these physical property changes can be attributed to the effect trace amount of moisture has on the bond between the propellants' binder and oxidizer. Author

N79-15201# Naval Weapons Station, Yorktown, Va. Explosives Development Engineering Dept.
PREDICTING HIGH EXPLOSIVE DETONATION VELOCITIES FROM THEIR COMPOSITION AND STRUCTURE Final Report
Lewis R. Rothstein and Robert Peterson Sep. 1978 24 p
(AD-A060889; NWSY-TR-78-3) Avail: NTIS HC A02/MF A01 CSCL 19/1

A simple, empirical linear relationship between detonation velocity at theoretical maximum density and a factor, F, that is dependent solely upon chemical composition and structure is postulated for a gamut of ideal explosives. The explosives ranged from nitroaromatics, cyclic and linear nitramines, nitrate esters and nitro-nitrato aliphatics to zero hydrogen explosives, carbonless explosives and hydrogen rich explosives. Of the 64 explosives evaluated, 72% had calculated detonation velocity values within 3% of experimental and 95% within 7%. Only mixtures of TNM and NM and TNM itself varied grossly (greater than 20%) from calculated velocities and the absolute error for all explosives is + or - 2.8%. Predicted C-J detonation pressures for 19 explosives had an absolute error of + or - 10% and when TNM was excluded, an absolute error of + or - 6.5%. With the exception of TNM and its mixtures, these results compare favorably with more complex predictive models. Author (GRA)

N79-15202# Army Armament Research and Development Command, Dover, N. J. Large Caliber Weapons Systems Lab.
PROPAGATION RATES IN THERMALLY IGNITED PYROTECHNIC COMPOSITIONS Final Report
Richard W. Collett Aug. 1978 52 p refs
(AD-A060809; AD-E400198) Avail: NTIS HC A04/MF A01 CSCL 19/1

The propagation rates that occur in loose, granular, confined pyrotechnic compositions were determined for thermal initiation. The same compositions under the same conditions were previously shown to detonate with strong shock initiation. All of the compositions tested developed fast reaction rates which could be extremely hazardous. Burning was found to accelerate to a high rate; this is best explained by a convective burning mechanism. Since the final reaction rates of the loose powder appeared to exceed the speed of sound, they are categorized as detonative. Since most rates measured were substantially lower than those observed for strong shock initiation and only slightly higher than the estimated speed of sound, they were considered to be non-ideal, low-order detonations. Author (GRA)

N79-15203# Dayton Univ. Research Inst., Ohio.
BEHAVIOR OF NONMETALLIC MATERIALS IN SHALE OIL DERIVED JET FUELS AND IN HIGH AROMATIC AND HIGH SULFUR PETROLEUM FUELS Final Report, Jan. 1975 - Aug. 1977
William E. Berner and Leonard C. Angello Wright-Patterson AFB, Ohio AFML Jul. 1978 84 p refs
(Contract F33615-76-C-5034; AF Proj. 2421)
(AD-A060322; AFML-TR-78-100) Avail: NTIS HC A05/MF A01 CSCL 21/4

Aircraft materials that are normally in contact with or exposed to fuels were evaluated in order to determine their compatability with fuels previously considered unacceptable, such as those derived from shale oil or those having high levels of aromatics, sulfur, and mercaptan sulfur. Adhesives, coatings, sealants, O ring seals, and clamps were studied in ten fuel formulations. A.R.H.

N79-15204# Army Armament Research and Development Command, Aberdeen Proving Ground, Md. Ballistics Research Lab.
EROSIVITY OF A NITRAMINE PROPELLANT
Robert W. Greene, J. Richard Ward, Timothy L. Brosseau, Andrus Niiler, and Robert Birkmire Aug. 1978 32 p refs
(AD-A060590; AD-E430118; ARBRL-TR-02094) Avail: NTIS HC A03/MF A01 CSCL 19/1

To achieve extended ranges with lightweight guns, the Army uses propellants with flame temperatures greater than 3000K. Such propellants erode gun steel, leading to undesirably short wear lives. One solution to this problem is development of propellants with comparable performances and lower flame temperatures. Nitramine-containing propellants offer such possibilities, but previous experiments indicated the nitramine propellants were more erosive than conventional propellants. In view of the need for high-force, low-flame temperature propellants, it was important to re-examine the earlier unexpected results. A series of experiments was conducted in a 37mm blow-out gun with a high impetus nitramine propellant containing 37-percent RDX and four standard Army propellants: M1, M30, M5, and M8. The nitramine propellant has a flame temperature about the same as M5 and an impetus slightly greater than M8 propellant. The erosivities of the five propellants were measured by mass loss of a contoured nozzle. A radioactive technique was also used which measured the amount of wear of the contoured nozzle. GRA

N79-15205# Villanova Univ., Pa. Dept. of Chemistry.
SOLID PROPELLANT ADDITIVES FROM PENTABORANE-9 Final Report, 1 Apr. 1977 - 30 Jun. 1978
Amos J. Leffler and Michael S. Spritzer Jun. 1978 42 p refs
(Grant AF-AFOSR-3301-77; AF Proj. 2303)
(AD-A060687; AFOSR-78-1409TR) Avail: NTIS HC A03/MF A01 CSCL 21/9

The electrochemical behavior of pentaborane-9 and its

reactivity with acetylenic halides were studied. Although pentaborane-9 is itself not electro-active it does react with other electrochemically generated species. It was found that methyl iodide, iodobenzene, chromium hexacarbonyl, dimanganese decacarbonyl, and iron pentacarbonyl generated electroactive species that reacted with pentaborane-9. The reaction of pentaboryllithium and propargyl chloride and with 1-4-dichlorobutyne-2 yielded mixtures of nidocarborane polymers and some higher boranes. The propargyl chloride reaction product reacted with anhydrous cobaltous chloride and cyclopentadienyllithium to give a mixture of cobaltaboranes and cobaltacarboranes which were not separable. An attempt was made to prepare phenylpentaborane but the product could not be isolated.
Author (GRA)

N79-15206# Army Missile Research and Development Command, Redstone Arsenal, Ala. Technology Lab.
A COUPLED INTERIOR BALLISTICS-FINITE ELEMENT COMBUSTION INSTABILITY ANALYSIS PROCEDURE
Robert M. Hackett Jul. 1978 46 p refs
(AD-A060554; DRDMI-T-78-72) Avail: NTIS HC A03/MF A01 CSCL 21/9

An executive routine is developed which should provide the solid propellant grain designer with the capability of performing an interior ballistics analysis while, with a minimum amount of additional effort, at the same time performing a combustion instability prediction analysis of the system. The routine, in effect, couples the output of an existing solid propellant grain design evaluation code, which predicts the acoustic chamber geometry during surface regression, with the input to the existing three-dimensional finite element combustion instability prediction code, FLAP3. The three-dimensional finite element mesh and boundary conditions are generated from the grain surface regression data for the progressive burn times. The entire finite element mesh and boundary condition generation by FLESH3, the companion to FLAP3, is executed with the input of seven parameters, which are obtained from the ballistics code output or from the initial grain geometry. The use of the developed routine, in conjunction with the two existing codes, is demonstrated through a number of example cases of a star design, along with the case of a shell design. Author (GRA)

N79-15207# Massachusetts Inst. of Tech., Cambridge. Marine Industry Advisory Services.
THE ECONOMICS AND ENGINEERING OF LARGE-SCALE ALGAE BIOMASS ENERGY SYSTEMS
Norman Doelling May 1978 34 p refs Sponsored by NOAA, Rockville, Md.
(PB-287868/4; MITSG-78-11; Opportunity-Brief-11; NOAA-78090601; Index-78-711-Zlg) Avail: NTIS HC A03/MF A01 CSCL 21D

The current state of the art and the potential of aquatic plant biomass systems over the next three to five years is outlined to suggest industrial development and research opportunities. Giant kelp (Macrocystis) capable of prodigious absolute growth rates (but low percentage growth rates), is recognized as a choice source of biomass for energy. The major unsolved problem in algal farms is harvesting the algae in a way that does not consume more energy than it produces. Centrifuging and drying require so much energy as to be prohibitive. Some form of filtering and concentration of the algae, by means of induced settling, floatation, or filtering, followed by anaerobic digestion of the algae medium to produce methane is the most probable technique. GRA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N79-15208# Stanford Univ., Calif. Edward L. Ginzton Lab.
ACOUSTIC MICROSCOPY AT CRYOGENIC TEMPERATURES Annual Summary Report, 1 Jul. 1977 - 30 Jun. 1978
C. F. Quate and J. Heiserman 29 Sep. 1978 22 p refs
(Contract N00014-77-C-0412)
(AD-A060391; GL-2865) Avail: NTIS HC A02/MF A01 CSCL 14/2

The objective of CAST is to establish the necessary structural and manufacturing technologies and to demonstrate and validate the integrity, producibility, and viability of cast aluminum primary airframe structures. The necessary casting foundry practices and related manufacturing technologies needed to cast aluminum primary structural components are discussed in this report. This effort involved extensive characterization of each step of the casting process to define acceptable limits of the process parameters. Author (GRA)

N79-15209# National Bureau of Standards, Washington, D. C.
WIND AND SEISMIC EFFECTS: PROCEEDINGS OF THE 9TH JOINT PANEL CONFERENCE OF THE US-JAPAN COOPERATIVE PROGRAM IN NATURAL RESOURCES Final Report
H. S. Lew, ed. Sep. 1978 522 p refs Conf. held at Tokyo, 24-27 May 1977
(PB-286993/1; NBS-SP-523; LC-78-600082) Avail: NTIS HC A22/MF A01 CSCL 13M

The proceedings include the program, the formal resolutions, and the technical papers. The subjects covered in the paper include: (1) characteristics of strong winds; (2) wind loads on structures and design criteria; (3) earthquake prediction; (4) earthquake ground motions and soil failures; (5) seismic loads on structures and design criteria; (6) design of special structures; (7) earthquake hazard reduction program; and (8) quantitative evaluation of damages caused by winds and earthquakes. GRA

N79-15210# National Bureau of Standards, Washington, D. C. Center for Building Technology.
ASEISMIC DESIGN OF BUILDING SERVICE SYSTEMS: THE STATE-OF-THE-ART Final Report, Aug. 1975 - Dec. 1976
C. W. C. Yancey and A. A. Camacho Sep. 1978 86 p refs
(PB-286907/1; NBS-TN-970) Avail: NTIS HC A05/MF A01 CSCL 13M

A search for information was conducted to define the state-of-the-art of aseismic design of building service systems and to identify areas of needed research. The study focused primarily on service systems essential to the continuous operation of hospital facilities in post-earthquake periods. A review of the literature pertaining to seismic performance of nonstructural systems is presented. An evaluation of code and standard regulations applicable to the aseismic design of service system components is also presented. Information obtained from direct contact with several federal agencies, the State of California, and practicing architects and engineers is summarized. GRA

N79-15211# Weidlinger Associates, New York.
THE ROLE OF CORROSION IN THE SEISMIC PERFORMANCE OF BURIED STEEL PIPELINES IN THREE UNITED STATES EARTHQUAKES
J. Isenberg Jun. 1978 85 p refs
(Grants NSF ENVP-76-9838; NSF PFR-78-15049)
(PB-285725/8; NSF/RA-780226; Rept-6) Avail: NTIS HC A05/MF A01 CSCL 13K

The condition of underground water pipelines following earthquakes in Puget Sound, Santa Rosa, California, and San Fernando, California is discussed with emphasis on steel pipe damage in regions where the maximum ground displacements are of the order of 10 cm. Numerous leaks in the pipes were traced to local weaknesses caused by corrosion. Corrosion control programs used by utilities discussed include wrapping and cathodic protection, and replacement of corroded pipe with noncorroding asbestos-cement pipe. GRA

N79-15212# Weidlinger Associates, New York.
STRENGTH AND DYNAMIC CHARACTERISTICS OF MECHANICALLY JOINTED CAST-IRON WATER PIPELINES
R. G. Kratky and M. G. Salvadori Jun. 1978 48 p refs
(Grants NSF ENVP-76-9838; NSF PFR-78-15049)
(PB-285727/4; NSF/RA-780224; Rept-3A) Avail: NTIS HC A03/MF A01 CSCL 13K

Elastic and dynamic characteristics of mechanical joints with rubber gaskets and cast-iron pipes are discussed. The main characteristics for pipe failure are the ultimate tension force and the ultimate bending moment. Bolt failure, ultimate gasket friction,

the longitudinal elastic constant of gasket, longitudinal periods of pipe due to gasket elasticity, longitudinal periods of pipe due to pipe elasticity, the rotational constant of gasket, period of rotational motion due to gasket, and period of vibration for vertical anti-symmetrical rotational modes of continuous elastic pipes are topics discussed. Some calculations are carried out as examples. GRA

N79-15213# Weidlinger Associates, New York.
STRENGTH AND DYNAMIC CHARACTERISTICS OF GASKET-JOINTED CONCRETE WATER PIPELINES
R. G. Kratky and M. G. Salvadori Jun. 1978 291 p refs
(Grants NSF ENVP-76-9838; NSF PFR-78-15049)
(PB-285728/2; NSF/RA-780225; Rept-5) Avail: NTIS HC A13/MF A01 CSCL 13K

Types of concrete pipe and their usage are discussed with emphasis on prestressed concrete cylinder pipe and prestressed concrete embedded cylinder pipe. Only straight jointed pipelines are considered. The actual performance of some existing concrete pipelines, dates of installation, and types of failure are included. Some test data on pipes and joints are considered. The general design methods used by the manufacturing industry are illustrated by means of examples. Recommendations on pipe design by the Bureau of Reclamation and the American Water Works Association are examined. GRA

N79-15214# Texas Technological Univ., Lubbock. Inst. for Disaster Research and Dept. of Civil Engineering.
A STUDY OF BUILDING DAMAGE CAUSED BY WIND FORCES Final Report
James R. McDonald and Patrick A. Lea Jan. 1978 79 p ref
(Contract V-101C-332)
(PB-286604/4) Avail: NTIS HC A05/MF A01 CSCL 13M

The kinds of major damage inflicted on hospital buildings by wind conditions were determined by survey and a procedure was developed to identify potential wind force damage to property. The historical performance of various structural systems is described and previous damage to buildings, electrical systems and sources of injury to building occupants are identified. A questionnaire is included which provides a methodology for evaluating the potential performance of hospital facilities in windstorms. GRA

N79-15215# California Univ., Richmond. Earthquake Engineering Research Center.
DYNAMIC BEHAVIOR OF A PEDESTAL BASE MULTISTORY BUILDING
R. M. Stephen, E. L. Wilson, J. G. Bouwkamp, and M. Button Jul. 1978 156 p refs
(Grant NSF ENV-76-04262)
(PB-286650/7; UCB/EERC-78-13; NSF/RA-780268) Avail: NTIS HC A08/MF A01 CSCL 13M

As a part of a continuing program to evaluate the dynamic response of actual structures and to accumulate a body of information on the dynamic properties of structures, especially when these structures have novel design features, a dynamic test program was conducted on the forty-two story Rainer Tower Building. Equally important, this program is aimed at evaluating the accuracy of computer modeling techniques and programs by comparing the experimentally derived dynamic response data with analytically predicted values. The dynamic tests of the building included both a forced vibration study and an ambient vibration study. A mathematical computer model of the Rainer Tower was formulated, and the results of the analysis are presented and compared to the experimental results. GRA

N79-15216# Wiggins (J. H.) Co., Redondo Beach, Calif.
BUILDING LOSSES FROM NATURAL HAZARDS: YESTERDAY, TODAY AND TOMORROW
J. D. Chrostowski, R. T. Eguchi, and G. C. Hart 1978 22 p refs
(Grants NSF ENV-77-08435; NSF AEN-74-23993; NSF ENV-76-24658; NSF ERP-75-09998)
(PB-286626/7; NSF/RA-780278) Avail: NTIS HC A02/MF A01 CSCL 13M

A forecast of building losses resulting from natural hazards was described to be used as a basis for establishing research priorities and public policy directions. The hazards selected for study were earthquake, landslide, expansive soil, hurricane wind/storm surge, tornado, riverine flood, local wind, local flood, and tsunami. Each of the hazards was first modeled and programmed on computers to provide estimates of annual and, in some cases, sudden catastrophic losses which might impart upon the nation's building wealth between 1970 and 2000. Computer modeling was also applied to various mitigations which could be developed and implemented to reduce loss. Potential loss reductions were then projected and evaluations made on both state and national bases. GRA

N79-15217# Scientific Service, Inc., Redwood City, Calif.
THE USE OF STRUCTURAL FOAMS TO IMPROVE EARTHQUAKE RESISTANCE OF BUILDINGS Final Report, 1 Oct. 1977 - 30 Jun. 1978
B. L. Gabrielsen and R. Lindskog Jun. 1978 310 p
(Grant NSF PFR-77-21426)
(PB-287121/8; Rept-7732) Avail: NTIS HC A14/MF A01 CSCL 13M

The feasibility of using polyurethane foam to increase the shear capacity of timber stud walls, timber joist floors, and ceilings and foundation to floor connections was studied. The results of the largely experimental program indicated that substantial increases in shear strength were achieved in walls, floors, and ceiling systems. It was shown experimentally, however, that a floor system (2 X 8 joist, 1 X 8 sheathing) when foamed developed a 1650 lb/ft shear enhancement and 2450 lb/ft composite shear capacity. Also, from an energy standpoint the energy absorbed by a foamed panel was approximately 10 times that of an unfoamed panel. Tests of floor-to-foundation connections upgraded by foam also indicate substantial increases. GRA

N79-15218# Joint Publications Research Service, Arlington, Va.
TRANSLATIONS ON USSR SCIENCE AND TECHNOLOGY: PHYSICAL SCIENCES AND TECHNOLOGY, NO. 56
14 Dec. 1978 58 p refs Transl. into ENGLISH from various Russian journals
(JPRS-72448) Copyright. Avail: NTIS HC A04/MF A01

Various topics in electronics and electrical engineering and instrumentation and photography are considered. Specifically, lens designs for radiation detectors, mathematical modeling of digital electrical drives, and a Kalman-Bulchy filter for correlating analog-digital data are covered. For individual titles, see N79-15219 through N79-15221.

N79-15219# Joint Publications Research Service, Arlington, Va.
ON THE QUESTION OF IMMERSED RADIATION DETECTORS **c35**
P. T. Ivanov, I. L. Anitropova, and Yu. S. Levitin *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 56 (JPRS-72448) 14 Dec. 1978 p 17-21 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Proborostr. (Moscow), no. 9, Sep. 1978 p 108-112 (For primary document see N79-15218 06-31)
Copyright. Avail: NTIS HC A04/MF A01

Problems of improving the characteristics of radiation detectors by the use of various types of immersion lenses are considered. J.M.S.

N79-15220# Joint Publications Research Service, Arlington, Va.
THE POSSIBILITIES OF MATHEMATICAL MODELING OF DIGITAL ELECTRIC DRIVES WITH STEPPING MOTORS **c33**
Yu. A. Sabinin, V. I. Kuleshov, S. V. Shlepkov, and M. M. Shmyreva *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 56 (JPRS-72448) 14 Dec. 1978 p 22-28 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Proborostr. (Leningrad), v. 21, no. 4, 1978 p 43-49 (For primary document see N79-15218 06-31)
Copyright. Avail: NTIS HC A04/MF A01

The modeling of stepping motors (ShD) on analog and digital computers is considered. The generalized equations of motion of ShD are presented in coordinates converted to rotational axes. J.M.S.

N79-15221# Joint Publications Research Service, Arlington, Va.
A KALMAN-BUCY FILTER FOR CORRELATED ANALOG-DIGITAL OBSERVATIONS **c33**
N. S. Demin and V. V. Petrov *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 56 (JPRS-72448) 14 Dec. 1978 p 29-35 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Proborostr. (Leningrad), v. 21, no. 5, 1978 p 14-19 (For primary document see N79-15218 06-31)
Copyright. Avail: NTIS HC A04/MF A01

The problem of filtration when time-digital observations are also made along with analog observations and the noise in the analog and digital observation channels are correlated between each other is considered. A system of differential-recurrent relations convenient for realization on a digital computer, which determines the Kalman-Bucy filter for this problem, is found.
J.M.S.

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

N79-15222*# Future Systems, Inc., Gaithersburg, Md.
SATELLITES: A SYSTEMS COMPARISON Monthly Progress Report
18 Oct. 1978 39 p
(Contract NASw-3212)
(NASA-CR-158003; MPR-1; FSI-221) Avail: NTIS HC A03/MF A01 CSCL 17B

The advantages of using geostationary platforms as a means of accommodating future missions and payloads in lieu of individual, smaller satellites are reviewed. The cost effectiveness of large capacity communications platforms with separate smaller satellites on a systems basis considering total costs to the end user is assessed. For two specific systems: a system to provide communications for U.S. domestic applications and a system to serve the Atlantic INTELSAT requirements. These simple platform applications were selected because they minimize associated institutional problems. Although they do not exploit the full advantages that can ultimately be obtained from large platforms with multidiscipline missions, to the extent that these simple platforms demonstrate cost benefits, such benefits can be further enhanced by the addition of other payloads to the platforms.
A.R.H.

N79-15223# National Aviation Facilities Experimental Center, Atlantic City, N. J.
TEST AND EVALUATION OF THE AIRPORT SURVEILLANCE RADAR PERFORMANCE MONITOR Final Report, Feb. 1975 - Apr. 1976
Domenick L. Offi Sep. 1978 23 p
(FAA Proj. 021-241-120)
(AD-A060328; FAA-NA-78-36; FAA-RD-78-102) Avail: NTIS HC A02/MF A01 CSCL 17/9

A radar performance monitor developed to operate with Federal Aviation Administration (FAA) Airport Surveillance Radar Systems was tested at the National Aviation Facilities Experimental Center (NAFEC). Tests were made to determine compliance with design specifications and to evaluate its capabilities and limitations. Tests conducted in the NAFEC ASR-7 testbed demonstrated a capability to satisfactorily monitor normal video figure-of-merit following some reconfiguration, but indicated incompatibilities with regard to radar moving target indicator (MTI) performance. It is recommended that future monitor development consider design changes dicussed in this report.
Author

N79-15224# North Carolina Univ. at Chapel Hill. Dept. of Statistics.
SIGNAL RECONSTRUCTION AFTER NOISY NONLINEAR TRANSFORMATIONS
Elias Masry (California Univ. at San Diego, La Jolla) and Stamatis Cambanis 1978 29 p refs
(Contract N00014-75-C-0652; Grant AF-AFOSR-2796-75; AF Proj. 2304)
(AD-A060426; AFOSR-78-1370TR) Avail: NTIS HC A03/MF A01 CSCL 20/1

A deterministic signal in zero means Gaussian noise N is observed through a zero memory nonlinearity f(x). The reconstruction of the signal is considered when the nonlinearity, the noise covariance and the first or second order moments of the output process f(s-n) are known. Arbitrary signals can be reconstructed for monotonic and certain odd, not necessarily monotonic, nonlinearities; included here are hard limiters, quantizers and infinite interval windows. Arbitrary signals can be reconstructed, up to a global sign, for two distinct classes of even nonlinearities; included here are 2v-th law devices and symmetric interval windows.
Author (GRA)

N79-15225# Naval Research Lab., Washington, D. C. Communication Sciences Div.
MODULATION AND CODING STUDY FOR THE ADVANCED NARROWBAND DIGITAL VOICE TERMINAL Interim Report
W. M. Jewett and R. Cole Aug. 1978 89 p refs
(AD-A060367; NRL-MR-3811) Avail: NTIS HC A05/MF A01 CSCL 17/2

A study was performed of modulation and coding techniques to support development of specifications for an advanced narrowband digital voice terminal. Emphasis was on the development of a signal design for HF radio transmissions. The results indicate that transmission channel effects can be significantly reduced by the application of forward acting error correction coding to the most sensitive bits of the digital voice signal. A recommendation is made to use the Golay (24, 12) code, with soft decision decoding, to protect 44 percent of each frame of data generated by a linear predictive encoder. This would result in a transmission rate of 3466.6 bps for an input of 2400 bps using multi-tone four phase differentially coherent phase shift keying.
Author (GRA)

N79-15226# Mitre Corp., Bedford, Mass.
TEST RESULTS ADVANCED DEVELOPMENT MODELS OF BISS IDENTITY VERIFICATION EQUIPMENT. VOLUME 2: AUTOMATIC SPEAKER VERIFICATION
Martin J. Foodman Jul. 1978 161 p refs
(Contract F19628-77-C-0001; AF Proj. 4130)
(AD-A056772; MTR-3442-Vol-2; ESD-TR-78-150-Vol-2) Avail: NTIS HC A08/MF A01 CSCL 17/2

Results are presented of testing the developmental model for speaker personal identity verification. The purpose of the program was to determine the Type 1 error rate (false rejection of authorized personnel), random Type II error rate (false admittance of unauthorized personnel), and throughput. Volume I present the detailed results of the handwriting and fingerprint systems, respectively. Volume V presents several miscellaneous but related subjects.
Author

N79-15227# Rome Air Development Center, Griffiss AFB, N.Y.
THE DIAGNOSTIC RHYME TEST (DRT): AN AIR FORCE IMPLEMENTATION
Steven Meister May 1978 204 p refs
(AD-A060917; RADC-TR-78-129) Avail: NTIS HC A10/MF A01 CSCL 17/2

The Diagnostic Rhyme Test (DRT) for intelligibility of voice communications systems has been implemented at the Air Force Voice Processing Facility, Hanscom AFB, Massachusetts. This report describes the recruiting and training of listeners and the usage of software to score the DRT. In addition, performance of the in-house DRT is described. It is concluded that the in-house DRT is an economical measure of intelligibility that yields highly reliable results and adequately discriminates small differences in intelligibility. It is further concluded that in-house DRT results are comparable to those obtained by a contractor. Author (GRA)

N79-15228# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Electrical and Systems Engineering.
TWO DIMENSIONAL RECURSIVE ESTIMATION WITH APPLICATION TO REAL-TIME FILTERING OF IMAGES Interim Report, 1 Jul. 1977 - 31 Jul. 1978
John W. Woods Jul. 1978 5 p refs

(Grant AF-AFOSR-3361-77)
(AD-A060689; AFOSR-78-1407TR) Avail: NTIS HC A02/MF A01 CSCL 20/6

The main goal of this program is the development of efficient methods for the two-dimensional (2-D), recursive filtering of images corrupted by noise. This goal is to be achieved by the use of extension of Kalman recursive estimation techniques to two-dimensions, which permits order-of-magnitude savings in computer time and storage over previously developed techniques for optimal recursive estimation of noisy images. Such images could arise for example in a communications context by an image transmission system which is noise limited because of power constraints. Author (GRA)

N79-15229# Naval Research Lab., Washington, D. C.
DETERMINATION OF TARGET ALTITUDE WITH A TWO-DIMENSIONAL FREQUENCY-AGILE RADAR Interim Report
Clifford L. Temes Jul. 1978 13 p
(AD-A060747; AD-E000221; NRL-8249) Avail: NTIS HC A02/MF A01 CSCL 17/9

A technique is described for determining target altitude utilizing the frequency dependence of the multilobe antenna beam pattern resulting from sea reflections. A frequency-agile 2D radar is assumed. Author (GRA)

N79-15230# Naval Research Lab., Washington, D. C.
TRACK INITIATION IN A DENSE DETECTION ENVIRONMENT
G. V. Trunk and J. D. Wilson Jul. 1978 24 p refs
(RR0140941)
(AD-A060744; AD-E000223; NRL-8238) Avail: NTIS HC A02/MF A01 CSCL 17/9

In a dense detection environment present track-while-scan algorithms will inevitably introduce false tracks when processing is performed on a scan-by-scan basis. The maximum likelihood solution involving all detections on all scans is formulated and evaluated for the initiation problem. While the maximum likelihood method cannot be implemented because of the enormous computational requirements, it provides a standard with which to compare algorithms that can be more readily implemented. Author (GRA)

N79-15231# Network Analysis Corp., Great Neck, N. Y.
ECONOMIC ANALYSIS OF INTEGRATED DOD VOICE AND DATA NETWORKS Final Report
Howard Frank and Israel Gitman Sep. 1978 174 p
(Contract DAHC15-73-C-0135; ARPA Order 2286)
(AD-A059981) Avail: NTIS HC A08/MF A01 CSCL 17/2

Alternative switching strategies for future integrated DOD voice and data networks are evaluated. Three fundamental problems are addressed: (1) the economics of integrating voice and data applications in a common communications system; (2) the comparison of alternative switching technologies for integrated voice and data networks; and (3) the cost effectiveness of alternative voice digitization rates and strategies. It is concluded that the packet-switching technology is substantially more cost effective for serving DOD voice and data requirements than the other alternatives examined. J.M.S

N79-15232# Range Commanders Council, White Sands Missile Range, N. Mex.
FLIGHT TERMINATION RECEIVER CATALOG
Sep. 1978 145 p
(AD-A058656; RSG-306-78) Avail: NTIS HC A07/MF A01 CSCL 17/2

The catalog provides a ready reference to UHF flight termination receivers used at missile ranges and test facilities. Approval for use of a particular receiver on one range for a given missile does not constitute automatic approval for use of the same receiver on other missile/space vehicles on the same range, or on the same missile space/vehicle on other ranges. G.G.

N79-15233# Defence Research Establishment Pacific, Victoria (British Columbia).
THE EFFECT OF AN INTERFERING SIGNAL ON THE PERFORMANCE OF NONPARAMETRIC DETECTORS USING SPECTRAL ESTIMATES
M. J. Wilmut and R. F. MacKinnon Dec. 1977 18 p refs
(AD-A052350; DREP-TM-77-11) Avail: NTIS HC A02/MF A01 CSCL 20/14

Nonparametric statistics have been previously applied to spectral data in order to detect narrow band signals. Here we show the degradation in performance due to the presence of an interfering signal. A modified decision scheme is proposed to overcome this problem. It is shown that with this new technique the presence of even a strong interfering signal does not seriously affect the ability to detect signals. Author (GRA)

N79-15234# Naval Research Lab., Washington, D. C. Radar Div.
SURVEILLANCE RADAR DETECTION (SURDET) PROGRAM Final Report
Laura C. Davis and Gerard V. Trunk 11 Aug. 1978 217 p refs
(RR01409)
(AD-A060733; AD-E000214) Avail: NTIS HC A10/MF A01 CSCL 17/9

The Surveillance Radar Detection (SURDET) model is a user-oriented computer model that produces target detections and position estimates for each radar scan. The model employs a variety of target trajectories and environments including jamming, multipath propagation, and rain and sea clutter. The model is a Monte-Carlo simulation, and the automatic detector is simulated on a pulse-to-pulse basis that takes into account target suppression and resolution effects in a dense-target environment. The output of this program can be used as the input for the Multiple Radar Integrated Tracking (MERIT) program. A model overview, instructions for the use of SURDET, sample outputs, and a detailed description of each SURDET routine are included in the report. Author (GRA)

N79-15235# Battelle Columbus Labs., Ohio.
DIELECTRIC GRATING ANTENNAS
S. T. Peng (Polytechnic Inst. of New York) and F. Schwering Jul. 1978 70 p refs
(Contract DAAG29-76-D-0100)
(AD-A060485; CORADCOM-78-3) Avail: NTIS HC A04/MF A01 CSCL 09/5

We present in this report a comprehensive and systematic study of dielectric grating antennas for use in millimeter wave systems. First of all, the feasibility of grating surface-wave structures for use as millimeter wave antennas is positively established on the basis of extensive numerical data for the case of infinitely wide gratings with uniform surface wave excitation at normal incidence. Secondly, a new approximation technique is introduced to obtain analytic formulas that are simple and useful for the practical design of grating antennas. Thirdly, the results for the normal incidence case are extended to the general case of oblique incidence, so that antennas of finite width can be rigorously investigated. Author (GRA)

N79-15236# Weapons Research Establishment, Salisbury (Australia).
ADAPTIVE BINARY CODING SCHEMES FOR TRADING DATA RATE FOR REDUCED SIGNAL TO NOISE RATIO REQUIREMENT
J. Hayward Feb. 1978 92 p
(AD-A060828; WRE-TR-1910(W)) Avail: NTIS HC A05/MF A01 CSCL 09/4

A detailed analysis is made of methods of increasing the redundancy of binary level data words so as to permit transmission at a reduced signal to noise ratio without an increase in error probability. Repeated transmission of the same data word is shown to be rather inefficient, especially if the integration is carried out after stages of non-linear detection and/or decoding. The need for care in ensuring the statistical independence between replicates, and between the individual bits of longer codewords, is shown. A cascade of a Golay cyclical error correcting coding process, followed by an orthogonal sparse coding, using maximum amplitude detection instead of threshold detection, is found to provide an efficient system where signal to noise ratio is restricted and energy consumption at the transmitter must be minimised. Replication can be used to provide an additional trade off during periods of abnormally low signal to noise ratio. An analysis is

also given to enable the calculation of losses arising from commonly used quasi-matched filters for the extraction of signal elements from Gaussian noise. Author (GRA)

N79-15237# Lincoln Lab., Mass. Inst. of Tech., Lexington.
INFORMATION PROCESSING TECHNIQUES PROGRAM, VOLUME 2: WIDEBAND INTEGRATED VOICE/DATA TECHNOLOGY Semiannual Technical Summary, 1 Oct. 1977 - 31 Mar. 1978
Bernard Gold 31 Mar. 1978 37 p
(Contract F19628-78-C-0002; ARPA Order 2929)
(AD-A060714; ESD-TR-78-203) Avail: NTIS HC A03/MF A01 CSCL 17/2

The goal of this program is the investigation and development of techniques for integrated voice and data communication in packetized networks which include wideband common-user satellite links. Specific areas of concern are the concentration of statistically fluctuating volumes of voice traffic; the adaptation of communication strategies to conditions of jamming, fading, and traffic volume; and the eventual interconnecting of wideband satellite networks to terrestrial systems. The current report covers work in two areas: a study of speech concentration requirements and a simulation of a technique for adaptive variable-rate packet speech networking. The speech concentration requirements study begins with an identification of the basic elements of a speech concentration facility and an outline of design objectives relating to the separation of functions among these elements. Access area options, voice terminal design issues, and concentrator requirements are then each discussed in more detail. The adaptive-networking efforts are based on an embedded speech coding technique coupled with priority-oriented packet handling and end-to-end flow control. The effects of these strategies are being studied in the context of a simple network topology consisting of a central node through which pass 16 paths connecting 4 nodes on either side. GRA

N79-15238# Maryland Univ., College Park. Dept. of Physics and Astronomy.
THE UNIVERSITY OF MARYLAND PROPOSAL TO DEVELOP DIGITAL DATA HANDLING AND PROCESSING EQUIPMENT FOR LLL SENSORS IN THE PRE-DETECTION COMPENSATION AND MAAI SYSTEMS Final Report
Douglas G. Currie May 1978 95 p refs
(Contract N00014-75-C-1176)
(AD-A060757) Avail: NTIS HC A05/MF A01 CSCL 17/2

The University of Maryland has developed a specialized data system for the operational and the recording requirements of the Multi-Aperture Amplitude Interferometer. The primary role of this data system is the operation of the University of Maryland Array Photometer. This array photometer is essentially an extremely sensitive low light level television, with special requirements on its various modes of operation. Thus we shall discuss its ability to take long integration pictures, scan rapidly, and partially scan an array. This procedure will increase the dynamic range by a factor as large as one hundred and will increase the frame rate up as high as several thousand frames per second. Several other special techniques which have been developed for the University of Maryland Array Photometer will be discussed and some of the results described. Author (GRA)

N79-15239# Naval Research Lab., Washington, D. C.
BISPHERICAL CONSTRAINED LENS ANTENNAS Interim Report
Jaganmohan B. L. Rao 2 Jun. 1978 12 p refs
(NRL Proj. R02-92; ZF12151001)
(AD-A060738; AD-E000226; NRL-8231) Avail: NTIS HC A02/MF A01 CSCL 09/5

A spherical constrained lens having two surfaces (a pickup surface and a radiating surface) of equal radii has been known to provide multiple beams in all planes. This lens is equivalent in performance to a spherical reflector antenna but has an advantage of generating multiple beams with true time delays and no feed blockage, since the feed surface is behind the pickup and radiating surfaces. An investigation has been made of a generalized bispherical constrained lens, with the radii of its two surfaces being allowed to vary. This additional degree of freedom allows flexibility in designing a multiple-beam antenna. It is shown that, for a specified radiating sperture and allowable maximum phase error, a lens with a smaller focal length F (or, equivalently, axial distance F between the feed and pickup surfaces), than that of the equal-radius lens can be obtained by increasing the radius of curvature of the radiating surface, resulting in a more compact lens. Author (GRA)

N79-15240# Massachusetts Inst. of Tech., Cambridge. Computer Science Lab.
A FAST SIGNATURE SCHEME
A. Shamir Jul. 1978 22 p refs
(Contract N00014-76-C-0366)
(AD-A057152; MIT-LCS-TM-107) Avail: NTIS HC A02/MF A01 CSCL 17/2

A scheme for generating and verifying 'electronic signatures' in public-key communications is proposed. The scheme is based on the difficulty of solving the knapsack problem, and its two main advantages over previous schemes are speed and simplicity. J.M.S.

N79-15241# California Univ., Davis. Dept. of Mathematics.
TWO CHARACTERIZATIONS FOR PASCAL SIGNALS IN ADDITIVE NOISE Interim Report
F. J. Samaniego and Gail G. Hannon Jul. 1978 20 p refs
(Grant AF-AFOSR-3180-77)
(AD-A059424; TR-5) Avail: NTIS HC A02/MF A01 CSCL 09/4

Let X be a nonnegative integer-valued variable whose distribution is the convolution of a Pascal distribution and another distribution on the nonnegative integers which does not depend on the Pascal parameters. The class of all such convolutions satisfying certain moment conditions is characterized by a system of differential equations satisfied by their probability mass functions. The result contains a characterization of Pascal distribution obtained as a special case. A characterization of convoluted geometric distributions not requiring moment conditions is also given. Author

N79-15242# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
MESSAGE TECHNOLOGY RESEARCH AND DEVELOPMENT Quarterly Progress Report, 2 Oct. 1977 - 2 Jan. 1978
J. Burchfiel and T. Myer Jul. 1978 49 p
(Contract MDA903-76-C-0212; ARPA Order 3161)
(AD-A056724; BBN-3783; QPR-8) Avail: NTIS HC A03/MF A01 CSCL 17/2

Three aspects of message system technology were studied: (1) HERMES support on the ARPANET: continued maintenance and support of HERMES, including efficiency improvements, functional refinement, revisions to the documentation and handling user inquiries and problems; (2) message system architecture: continued study and design work for a next generation message system employing distributed architecture techniques; and continued work on the front end module; experiment with a split system with the front and command scanner and command processor isolated on separate machines; and (3) advanced techniques: further development of the Message Technology Laboratory; extend the programming language, providing constructs and features not included in the preliminary version, and to explore further the potential of automation techniques. J.M.S.

N79-15243# Institute for Telecommunication Sciences, Boulder, Colo.
A PRELIMINARY ESTIMATE OF THE EFFECTS OF SPREAD-SPECTRUM INTERFACE ON TV
John R. Juroshek Jun. 1978 35 p refs Sponsored in part by Federal Communications Comm., Wash., D. C.
(PB-286633/3; NTIA/Rept-78/6) Avail: NTIS HC A03/MF A01 CSCL 17B

The conditions under which spread-spectrum, land-mobile radio and television can share spectrum is examined. After a preliminary assessment, the report concludes that the interference caused by a constant amplitude, spread-spectrum system should be comparable to that caused by a conventional, narrowband, FM, land mobile signal of same total power, provided the spread-spectrum signal has an rf bandwidth less than 2 MHz. With spectrum spreads greater than 6 MHz, the spread-spectrum system should have some advantage because of the out-of-band rejection capabilities of a TV receiver. A limited number of

laboratory measurements are also described that support the conclusions of the report. GRA

N79-15244# Institute for Telecommunication Sciences, Boulder, Colo.
ESTIMATES OF THE ATMOSPHERIC TRANSFER FUNCTION AT SHF AND EHF
E. J. Dutton Aug. 1978 34 p refs
(PB-286632/5; NTIA/Rept-78/8) Avail: NTIS HC A03/MF A01 CSCL 20N

Known theory is applied to examine the channel transfer function for earth/space propagation paths through the atmosphere and over the frequency range from 10 to 350 GHz. The associated attenuation and phase-delay characteristics are separated into the contributions of the clear sky, clouds, and rainfall. From the available meteorological data, the total path attenuation and phase-delay is estimated over the frequency range from 10 to 45 GHz for selected values of the initial elevation angles from a ground station near Washington, D.C. The associated attenuation coefficients (db/km) and phase-delay coefficients (rad/km) attributable to the clear air, clouds, and rainfall are also described for frequencies up to 350 GHz. GRA

N79-15560# Polytechnic Inst. of New York. Dept. of Electrical Engineering.
EVANESCENT WAVES AND WAVES IN ABSORBING MEDIA
Leopold Felsen *In* Bur. of Radiological Health The Phys. Basis of Electromagnetic Interactions with Biol. Systems Apr. 1978 p 149-163 Repr. from J. Opt. Soc. Am., v. 66, no. 8, 1976 p 751 (For primary document see N79-15551 06-51)
Avail: NTIS HC A18/MF A01

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N79-15245* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ELECTRIC DISCHARGE FOR TREATMENT OF TRACE CONTAMINANTS Patent
Daniel L. Flamm (Stanford Univ., Calif.) and Theodore J. Wydeven, Jr., inventors (to NASA) Issued 19 Dec. 1978 9 p Filed 23 May 1977 Supersedes N77-24771 (15 - 15, p 2033)
(NASA-Case-ARC-10975-1; US-Patent-4,130,490; US-Patent-Appl-SN-799832; US-Patent-Class-250-531; US-Patent-Class-250-540; US-Patent-Class-250-541) Avail: US Patent and Trademark Office. CSCL 09C

A radio frequency glow discharge reactor is described for removing trace oxidizable contaminants from an oxygen bearing atmosphere. The reaction chamber is defined by an inner metal electrode facing a dielectric backed by an outer conductive electrode. In one embodiment, a conductive liquid forms the conductor of an outer electrode and cools the dielectric. A resonator coupled to a variable radio frequency source generates the high voltages for creating a glow discharge in the chamber at a predetermined pressure whereby the trace contaminants are oxidized into a few simple non-toxic products that may be easily recovered. The corresponding process for removal of trace contaminants from an oxygen-bearing atmosphere with high efficiency independent of the concentration level is also disclosed. Official Gazette of the U.S. Patent and Trademark Office

N79-15246# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
WEFAX/INPE CONVERTER: OPERATION [CONVERSOR WEFAX/INPE: OPERACAO]
Wilton Jose Fleming and Carlos Santana Nov. 1978 53 p In PORTUGUESE
(INPE-1401-NTE/138) Avail: NTIS HC A04/MF A01

The operation and technical aspects of the converter are described. Transl. by F.O.S.

N79-15247*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE 25 kW POWER MODULE UPDATED BASELINE SYSTEM
Dec. 1978 85 p refs
(NASA-TM-78212) Avail: NTIS HC A05/MF A01 CSCL 09C

Analyses and trades were performed to improve the original base line system. This report describes a suggested new baseline that incorporated modifications to the September 1977 system. G.G.

N79-15248*# Matrix Research and Development Corp., Acton, Mass.
DEVELOPMENT OF HIGH RELIABILITY, HIGH FREQUENCY POWER CONDITIONING MODELS OF CONVERTER REGULATORS Final Report
Arthur W. Rochussen Jan. 1979 50 p
(Contract NAS5-23146)
(NASA-CR-159913; XF-79-1) Avail: NTIS HC A03/MF A01 CSCL 09C

High efficiency conversion, regulation, and filtering techniques are discussed for power using high conversion frequencies; i.e., in the order of 1 to 5 MHz for converters having total output power capability in the order of 20 watts and 200 to 500 KHz for converters having total output powers in excess of 200 watts. Work centered on areas of component selection, material selection, optimization of the various types of circuits required, and the selection of materials for and design of magnetic components. These techniques were then applied to the design of two sample converters, one a medium power instrument type converter and the second a high power converter representative of a primary spacecraft converter regulator. The configuration and performance of the two converters is reported and discussed. G. G.

N79-15249# Texas Technological Univ., Lubbock. Inst. for Electronics Science.
FAULT ANALYSIS IN ELECTRONIC CIRCUITS AND SYSTEMS, 2 Interim Report
R. Saeks, N. Sen, H. M. S. Chen, K. S. Lu, and S. Sangani Jan. 1978 349 p
(Contracts N00014-75-C-0924; N00014-76-C-1136)
(AD-A060941) Avail: NTIS HC A15/MF A01 CSCL 09/3

A summary of several research projects in the fault analysis area is given. Specific topics include test point sections, the formulation of a measure of testability for analog electronic circuits, test frequency selection, and fault diagnosis in linear and affine circuits. Author (GRA)

N79-15250# Stanford Univ., Calif. Dept. of Statistics.
AN EXTREMAL PROBLEM FOR POSITIVE DEFINITE MATRICES
Theodore W. Anderson and I. Olkin Jul. 1978 18 p refs
(Contract N00014-75-C-0442; Grant NSF MPS-75-09450)
(AD-A060866; SU-TR-34; SU-TR-130) Avail: NTIS HC A02/MF A01 CSCL 09/3

A problem studied by Flanders is to minimize the function $f(R) = tr\,(SR + TR^{-1})$ over the set of positive definite matrices R, where S and T are positive semi-definite matrices of rank m. Alternative proofs that may have some intrinsic interest are provided. The proofs explicitly yield the infimum of f(R). One proof is based on a convexity argument and the other on a sequence of reductions to a univariate problem. GRA

N79-15251# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
LIGHTNING STRIKE SUSCEPTIBILITY TESTS ON THE AIM-9 MISSILE Final Report, Oct. - Nov. 1977
Vernon L. Mangold, Christopher L. Blake, and Lawrence C. Walko Aug. 1978 55 p refs
(AD-A060844; AFFDL-TR-78-95) Avail: NTIS HC A04/MF A01 CSCL 16/4

Lightning strike susceptibility tests were conducted on AIM-9 missile forward sections to evaluate possible interface problems with the F16 aircraft. High voltage attachment, streamering and high current arc tests were performed using the specialized test

facilities and instrumentation of the Air Force Flight Dynamics Laboratory. It was experimentally determined that the optical dome/zinc-coated fiberglass interface at the forward end is the most probable attachment point to the AIM-9 missile. The optical dome was found to be highly vulnerable to direct lightning strikes but there is no evidence that lightning will penetrate the F-16 aircraft via the AIM-9 missiles. The operational status of the AIM-9 missile subsequent to a direct lightning strike is suspect; however, complete evaluation of this subject was beyond the scope of the program. Author (GRA)

N79-15252# Erie Technological Products of Canada Ltd., Trenton (Ontario).
MANUFACTURING METHODS AND TECHNIQUES FOR MINIATURE HIGH VOLTAGE HYBRID MULTIPLIER MODULES Quarterly Report, 1 Oct. - 31 Dec. 1977
Michael Korwin-Pawlowski 7 Feb. 1978 54 p Prepared for Canadian Commercial Corp., Ottawa
(Contract DAAB07-76-C-0041)
(AD-A052727; QR-6) Avail: NTIS HC A04/MF A01 CSCL 09/5

The results of testing of rectangular and curved multipliers to the Second Engineering Sample requirements are presented. Steps to improve the frequency performance of the multipliers and optimization of the rectifiers for these devices are discussed. Results of life testing of multipliers are presented. Author (GRA)

N79-15253# Army Electronics Technology and Devices Lab., Fort Monmouth, N. J.
MILLIMETER-WAVE/MICROWAVE DEVICE APPLICATIONS OF RARE EARTH-COBALT MAGNETS
F. Rothwarf, H. A. Leupold, and L. J. Jasper, Jr. Aug. 1978 28 p refs
(AD-A059754; DELET-TR-78-17) Avail: NTIS HC A03/MF A01 CSCL 20/3

There is considerable military interest in the utilization of rare earth (RE)-cobalt permanent magnets to facilitate the currently contemplated extension of device operating frequencies into the millimeter-wave region and to enhance the efficiency of devices operating at presently employed frequencies. Specific examples of proposed devices (traveling-wave tubes (TWT's), crossed-field amplifiers, etc.) are discussed, and expected magnet property requirements which would make them viable are reviewed. Future military millimeter-wave/microwave needs are presented and discussed in terms of magnet materials technology, and circuit design, and the requirement for improved quality control. Author

N79-15254# Radio Corp. of America, Lancaster, Pa.
MANUFACTURING METHODS AND TECHNOLOGY (MM AND T) MEASURE FOR FABRICATION OF SILICON TRANSCALENT THYRISTOR Quarterly Report, 1 Apr. 1978 - 30 Jun. 1978
B. B. Adams, S. W. Kessler, R. E. Reed, and D. R. Trout Jul. 1978 52 p
(Contract DAAB07-76-C-8120)
(AD-A060446; QR-7) Avail: NTIS HC A04/MF A01 CSCL 09/1

This Seventh Quarterly Report describes the progress on the MM and TE program for the Transcalent (Heat-Pipe cooled) thyristors. Production engineering measures for the device and the pertinent state-of-the-art on the sample devices are included. Test results on the first pilot production samples are listed. The present status includes the submission of the Preliminary Pilot Run Report, the preparations for the production rate demonstration and the fabrication of the initial pilot production samples. Plans for the next Quarter include the completion of the pilot run phase including the production rate demonstration. Author (GRA)

N79-15255# Lockheed Electronics Co., Plainfield, N. J. Products and Systems Div.
ENABLE/OPTION DEVICE DESIGN AND DEVELOPMENT PROGRAM Final Technical Report, 14 Feb. - 31 Dec. 1977
1978 109 p refs
(Contract DAAK10-77-C-0002)
(AD-A060404; LEC-93-1361) Avail: NTIS HC A06/MF A01 CSCL 16/1

The program included hardware design and development and technical data package generation and submission. The hardware effort involved development of electronic circuits, motor driver switch assemblies, E/OD packaging and test equipment generation. Drawings and data items included a TDP generated to best commercial practice for the E/OD and test equipment and CDRL items as required in the contract. The electronics effort included breadboarding of a single channel E/OD to allow investigation into isolation requirements and minimization of power dissipation; manufacture and test of a dual channel E/OD preliminary model built to the functional requirements as given in the contract; and development of a test set. The test set provides simulated input data and output load conditions typical of PERSHING missile system interface and monitors E/OD electronic function, as well as Enable Switch function per contract specification requirements. GRA

N79-15256# Harry Diamond Labs., Adelphi, Md.
TEMPERATURE COMPENSATION OF LAMINAR PROPORTIONAL AMPLIFIERS USING A LINEAR RESISTOR BYPASS
George Mon and Harold Robinson Sep. 1978 36 p
(AD-A060756; HDL-TM-78-16) Avail: NTIS HC A03/MF A01 CSCL 09/1

A theoretical and experimental study has been conducted on the use of the linear resistor bypass to compensate the supply nozzle Reynolds number of the laminar proportional amplifier (LPA) for temperature changes. Both the theoretical and experimental results indicate that the linear resistor bypass is a limited method for temperature compensation for the present LPA design because the supply nozzle of the LPA has a large linear resistance component. GRA

N79-15257# Lincoln Lab., Mass. Inst. of Tech., Lexington.
DISTRIBUTED SENSOR NETWORKS Semiannual Technical Summary Report, 1 Oct. 1977 - 31 Mar. 1978
Richard T. Lacoss 31 Mar. 1978 63 p refs
(Contract F19628-78-C-0002; ARPA Order 3345)
(AD-A060685; ESD-TR-78-208) Avail: NTIS HC A04/MF A01 CSCL 17/1

Progress on the Distributed Sensor Networks program is reported. Topics covered in the sensor area are the performance of acoustic sensors, sizing of acoustic front-end computation requirements, feasibility of adapting packet radios to perform as radar sensors, and a preliminary investigation of IR options. In all cases, the targets considered were low-flying aircraft or cruise missiles. Progress is reported in the area of decision theoretic surveillance space search methods of multisite detection and on specific algorithms to locate targets using two acoustic sites. Results of a preliminary parametric sensor and system cost analysis are given. Author (GRA)

N79-15258# Stanford Univ., Calif. Digital Systems Lab.
OPTIMAL LAYOUT OF CMOS FUNCTIONAL ARRAYS
T. Uehara and W. M. VanCleemput Mar. 1978 50 p refs
(Contract N00014-75-C-0601)
(AD-A060392; SU-DSL-TR-142) Avail: NTIS HC A03/MF A01 CSCL 09/5

Designers of MOS LSI circuits can take advantage of complex functional cells in order to achieve better performance. This paper discusses the implemention of a random logic function on an array of CMOS transistors. A graph-theoretical algorithm which minimizes the size of an array is presented. This method is useful for the design of cells used in conventional design automation systems. Author (GRA)

N79-15259# General Electric Co., Philadelphia, Pa. Space Div.
DEVELOPMENT OF HIGH LEVEL ELECTRICAL STRESS FAILURE THRESHOLD AND PREDICTION MODEL FOR SMALL SCALE JUNCTION INTEGRATED CIRCUITS Final Report
Hugh B. ODonnell and Dante M. Tasca Sep. 1978 193 p refs
(Contract DAAG39-76-C-0138; DA Proj. 1W1-62118-AD-75)
(AD-A060874; Doc-77SDS4253; HDL-CR-78-138-1) Avail: NTIS HC A09/MF A01 CSCL 18/3

This report summarizes the experimental and theoretical work performed in order to develop engineering type prediction

techniques to predict both surge impedances and failure levels of small scale junction integrated circuits when exposed to EMP type environments. A further requirement was that these predictive techniques should not require a 'hands on' device evaluation but should relate the surge impedance and failure levels to some associated device parameter which could easily be obtained from a manufacturer's data sheet or other published information. The data required to develop the models was obtained by a literature search of numerous DOD and NASA agencies and contractors. In addition, 252 integrated circuits were experimentally evaluated to determine their specific pulse response and damage characteristics. These 252 devices consisted of 11 individual part types, 7 digital part types and 4 linear part types. All pulse damage experiments were performed using unipolarity, single square wave pulses of 10 nanosecond to 1 microsecond duration. Models were generated for the power failure threshold as a function of pulse width, the current failure threshold as a function of pulse width and the impedance as a function of current. GRA

N79-15260# National Communications System, Arlington, Va.
EMP, LIGHTNING AND POWER TRANSIENTS: THEIR THREAT AND RELEVANCE TO EMP PROTECTION STANDARDS FOR TELECOMMUNICATION FACILITIES
Dennis Bodson Aug. 1978 38 p refs
(AD-A060629; NCS-TIB-78-1) Avail: NTIS HC A03/MF A01 CSCL 17/2

The electromagnetic pulse (EMP) is a phenomena created by nuclear explosions. It is a transient electromagnetic wave produced by exoatmospheric, atmospheric, and surface bursts and is characterized chiefly by its short duration, high intensity field. This electromagnetic field can cause severe disruption and possible damage to communications equipment. The most serious EMP threat is that from an exoatmospheric or high altitude burst which potentially can illuminate a large fraction of a communications network and simultaneously disrupt or damage communication equipment over a wide geographical user service area. It is EMP from the high altitude burst that is emphasized in this document since the EMP, blast, radiation, and thermal effects of atmospheric and surface bursts are only significant in negating geographically small communication functions. Lightning and Power line energy surges are discussed. The published surge characteristics for the time domain are provided and the energy threat defined for equipment connected to cable conductor interfaces. GRA

N79-15261# Naval Research Lab., Washington, D. C.
THEORY AND SINGLE WAVE SIMULATION OF THE GYROTRON TRAVELING WAVE AMPLIFIER OPERATING AT CYCLOTRON HARMONICS Interim Report
K. R. Chu and A. T. Drobot Aug. 1978 47 p refs
(MIPR-FY76-1970026)
(AD-A060709; AD-E000228; NRL-MR-3788) Avail: NTIS HC A03/MF A01 CSCL 20/5

The cyclotron maser interaction in a waveguide structure at the harmonics of the cyclotron frequencies has been studied in detail both analytically and with numerical simulations. An idealized cold beam, single wave model has been assumed and investigated using the relativistic Vlasov and Maxwell equations. Analytical scaling relations for the growth rate and efficiency have been derived and extensive simulation data obtained. Emphasis has been placed on methods of parameter optimization for maximizing beam to wave energy conversion efficiency. Beam frame efficiencies in the vicinity of 20% and 10% have been found for the third and fourth cyclotron harmonics, respectively. These results are capable of yielding preliminary design data for gyrotron traveling wave amplifiers. However, it should be noted that a number of important practical problems such as competition between spurious modes have not been considered in the context of the present single wave analysis. Furthermore, requirements on magnetic field uniformity and electron thermal spread become more stringent as cyclotron harmonic number increases and thus the realization of suitable experimental conditions may be expected to become increasingly difficult. Author (GRA)

N79-15262# Naval Research Lab., Washington, D. C.
HIGH TRANSITION TEMPERATURE SUPERCONDUCTORS-V3Ga WIRE DEVELOPMENT Annual Report
Robert A. Hein, Thomas L. Francavilla, Donald U. Gubser, David G. Howe, and Russell A. Meussner May 1978 38 p refs
(ZF54544009; SF54501592)
(AD-A060713; AD-E000233; NRL-MR-3839) Avail: NTIS HC A03/MF A01 CSCL 20/3

Increased V3Ga growth rates resulting from the use of high gallium content V-Ga filaments and Cu-Ga matrix alloys are utilized to improve the critical current density in the superconductor, J sub c, by forming thin layers of V3Ga at rather low reaction temperatures. Studies of J sub c as functions of magnetic field strength and temperature are reported and compared with similar data for experimental Nb3Sn wires, commercial V3Ga tapes, and Nb-Ti wire. These data document the superiority of V3Ga over a broad range of magnetic fields and temperatures. Based on results of these investigations of processing variables, specifications for high current (I sub c) multifilament V3Ga wires were defined and an industrial contract for their production was awarded (pertinent specifications appended). Studies of stress effects on I sub c have shown these developmental wires resistant to degradation at acceptable stress levels. Further work in this area is recommended for future superconducting applications. Author (GRA)

N79-15263# Michigan State Univ., East Lansing.
PULSE (PHOTON) COUNTING. I: DETERMINATION OF OPTIMUM MEASUREMENT SYSTEM PARAMETERS Interim Report
E. J. Darland, G. E. Leroi, and C. G. Enke Jul. 1978 33 p refs
(Contract N00014-76-C-0434; NR Proj. 394-009)
(AD-A059476; TR-2) Avail: NTIS HC A03/MF A01 CSCL 14/2

Linearity measurements and integral pulse height distributions were used to evaluate the effects of electron multiplier voltage and discriminator coefficient on the stability, sensitivity and dynamic range of three pulse counting measurement systems. The data show that selection of the highest possible voltage has significant advantages for most experiments, but that the choice of an optimum value depends on the requirements of the particular experiment. Semiquantitative evaluation of trade-offs on the basis of the experimental results is illustrated. The data also show clearly that measurements such as those reported here must be made on each system, since specific results for one system can not be generalized to others. G. G.

N79-15264# IRT Corp., San Diego, Calif.
RADIATION EFFECTS IN SATELLITE CABLES Final Report, 1 Apr. 1977 - 31 Mar. 1978
J. M. Wilkenfeld, Roland E. Leadon, and Charles E. Mallon Apr. 1978 186 p refs
(Contract DAAG39-76-C-0089)
(AD-A059446; IRT-8148-021; HDL-CR-78-089-1) Avail: NTIS HC A09/MF A01 CSCL 09/1

A combined experimental and analytical study was made of the mechanisms which determine the response of satellite cables to X-rays. Parameters investigated include gaps, with and without trapped air, polymer type, stored charge effects introduced by manufacturing or handling, trapping of space electrons in the dielectric, radiation conductivity, sample-to-sample and manufacturer-to-manufacturer variations, and dose effects. It was found that the principal mechanism enhancing response was the presence of gaps between conductors and dielectrics which are naturally present in braided shield cables and can be introduced by bending in semirigids. The presence of stored charge was less significant. An equilibrium distribution of trapped electrons will be built up in a period of about one-half hour for the artificial trapped environment and in about 20 days in the natural space environment, which will obliterate any previously stored charge. The so-called first pulse anomaly will occur only when one has a cable containing air filled gaps. In this case, the first shot rather than the nth shot response will be most typical of cable behavior. Author

N79-15265# Electronics Engineering Group (1842nd), Scott AFB, Ill.
UNIVERSAL PERFORMANCE ASSESSMENT AND CONTROL SYSTEM
Glenn F. McAvery Aug. 1978 68 p
(AD-A059455; Rept-1842-EEG/EEIM-TR-78-13) Avail: NTIS

HC A04/MF A01 CSCL 09/2

A general purpose computer controlled data acquisition and analysis system is reported that is capable of providing the following major functions: (1) control of test instrumentation by a master computer or ancillary computers under the control of the master computer; (2) data acquisition; (3) general computation and analyses; (4) storage of data on magnetic tape; and (5) graphical output of data. G.G.

N79-15266# Geological Survey, Denver, Colo.
A COMPUTER PROGRAM FOR CALCULATING THE DIRECT CURRENT RESISTIVITY RESPONSE FOR ELECTRODES BURIED IN A HORIZONTALLY STRATIFIED EARTH Final Report
Jeffrey J. Daniels 1978 67 p refs
(PB-286323-1; USGS-GD-78-010) Avail: NTIS HC A04/MF A01 CSCL 08I

A listing of a computer program to calculate the direct current resistivity response for electrodes buried within a horizontally layered earth is presented. The program is designed to calculate the response for the following electrode configurations: (1) hole-to-hole fixed source; (2) hole-to-hole moving source; (3) hole-to-hole surface with a fixed borehole source and a surface bipole receiver; (4) normal well logging array; (5) dipole-dipole well logging array; and (6) lateral well logging array. Examples are given for each of these arrays. GRA

N79-15220# Joint Publications Research Service, Arlington, Va.
THE POSSIBILITIES OF MATHEMATICAL MODELING OF DIGITAL ELECTRIC DRIVES WITH STEPPING MOTORS
Yu. A. Sabinin, V. I. Kuleshov, S. V. Shlepkov, and M. M. Shmyreva *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 56 (JPRS-72448) 14 Dec. 1978 p 22-28 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Proborostr. (Leningrad), v. 21, no. 4, 1978 p 43-49 (For primary document see N79-15218 06-31)
Copyright. Avail: NTIS HC A04/MF A01

N79-15221# Joint Publications Research Service, Arlington, Va.
A KALMAN-BUCY FILTER FOR CORRELATED ANALOG-DIGITAL OBSERVATIONS
N. S. Demin and V. V. Petrov *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 56 (JPRS-72448) 14 Dec. 1978 p 29-35 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Proborostr. (Leningrad), v. 21, no. 5, 1978 p 14-19 (For primary document see N79-15218 06-31)
Copyright. Avail: NTIS HC A04/MF A01

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics.*

N79-15267*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SOME HEAT TRANSFER AND HYDRODYNAMIC PROBLEMS ASSOCIATED WITH SUPERCONDUCTING CABLES (SPTL)
Robert C. Hendricks, David E. Daney (NBS, Boulder, Colo.), V. M. Yeroshenko (Krzhizhanovsky Power Inst., Moscow), Ye. V. Kuznetsov (Krzhizhanovsky Power Inst., Moscow), and O. A. Shevckenko (Krzhizhanovsky Power Inst., Mosow) 1978 28 p refs Presented at the US-USSR Comm. for Superconducting Power Transmission, Upton, N. Y., 5-6 oct. 1978
(NASA-TM-79023; DOE/NASA/0207-78/1) Avail: NTIS HC A03/MF A01 CSCL 20D

To study some effects of thermogravitation on (CIIK-SPTL) systems, a heated tube experiment was set up at Krzhizhanovsky Power Engineering Institute Moscow, U.S.S.R. Heat transfer data were taken with fluid helium flowing through a 2.85 m, 19 mm diameter uniformly heated horizontal tube. Temperatures were measured on the top and bottom of the tube at six axial locations with three other circumferential measurements made at (X/L) = 57. Typical temperature profiles show significant variations both axially and circumferentially. The data are grouped using reduced Nusselt number (NuR) and the bulk expansion parameter for each axial location. The average data for 0.26 less than or equal to X/L less than or equal to 0.76 follow a power law relation with the average expansion parameter. System instabilities are noted and discussed. Future work including heat transfer in coaxial cylinders is discussed. Author

N79-15268*# Hampton Inst., Va. Dept. of Engineering.
A SYSTEMS APPROACH TO THEORETICAL FLUID MECHANICS: FUNDAMENTALS Final Report
Joshua C. Anyiwo Nov. 1978 48 p refs
(Grant NsG-1456)
(NASA-CR-158014; ME78-2JCA) Avail: NTIS HC A03/MF A01 CSCL 20D

A preliminary application of the underlying principles of the investigator's general system theory to the description and analyses of the fluid flow system is presented. An attempt is made to establish practical models, or elements of the general fluid flow system from the point of view of the general system theory fundamental principles. Results obtained are applied to a simple experimental fluid flow system, as test case, with particular emphasis on the understanding of fluid flow instability, transition and turbulence. G.Y.

N79-15269# Purdue Univ., Lafayette, Ind. Project Squid Headquarters.
MODELING OF SCALAR PROBABILITY DENSITY FUNCTIONS IN TURBULENT FLOWS
Ashok K. Varma, Guido Sandri, and Peter J. Mansfield Aug. 1978 54 p refs
(Contract N00014-75-C-1143; Proj. SQUID)
(AD-A060445; SQUID-ARAP-1-PU) Avail: NTIS HC A04/MF A01 CSCL 20/4

Turbulent flows involving chemical reactions are a basic feature of many combustion and propulsion systems. The development of calculation procedures for turbulent reacting flows requires the understanding and modeling of the coupling between turbulence and combustion. Second-order closure modeling of turbulent flows provides a convenient framework for studying these interactions between turbulence and chemical reactions. Models for the scalar probability density function (pdf) have to be developed to achieve closure of turbulent transport equations for mixing and reacting flows. A delta function 'typical eddy' model has been developed for the joint pdf of the scalar variables. It has been demonstrated that delta functions are a necessary part of pdf's in order to attain the extremums of the statistical constraints on the moments. The statistical bounds on a number of moments of interest have been derived. It has been proven that a rational pdf composed of a set of delta functions alone can always be constructed at any point within the statistically valid moment space. The model provides a good representation of actual pdf's in two-species, variable-density mixing flows. The model has been directly compared to experimental pdf measurements and good agreement for higher-order moments has been demonstrated. It can be shown that the delta function pdf model is significantly simpler than other proposed pdf models and is more than adequate for the closure of the transport equations.
Author (GRA)

N79-15270# Rochester Univ., N. Y. Dept. of Electrical Engineering.
CAVITATION DYNAMICS Final Report
H. G. Flynn Oct. 1978 4 p
(Contract N00014-76-C-1080)
(AD-A060894) Avail: NTIS HC A02/MF A01 CSCL 20/4

Final report summarizes research carried out under subject contract and described in two reports: 'Cavitation Dynamics. III. Thresholds and Generation of Transient Cavities,' dated 25 July 1978 and 'Cavitation Dynamics. IV. Collapse of Transient Cavities,' dated 28 July 1978. Author (GRA)

N79-15271# Polytechnic Inst. of New York. Dept. of Mechanical and Aerospace Engineering.

AN OLD INTEGRATION SCHEME FOR COMPRESSIBLE FLOWS REVISITED, REFURBISHED AND PUT TO WORK
Gino Moretti Sep. 1978 37 p refs
(Contract N00014-75-C-0511; Grant DAAG29-77-G-0072; Grant NsG-1248; NR Proj. 061-135)
(AD-A060826; POLY-M/AE-78-22) Avail: NTIS HC A03/MF A01 CSCL 20/4

A scheme for integrating the Euler equations of compressible flow in any hyperbolic case is presented. The scheme relies on the concept of characteristics but is strictly a finite difference scheme. Improvements in accuracy and physical consistence due to the scheme are discussed and results of its application to complex flows are shown. Author (GRA)

N79-15272# Naval Academy, Annapolis, Md. Dept. of Physics.
ACOUSTIC CAVITATION INCEPTION IN WATER AND IN INSONATED ROOT TIPS
Lawrence A. Crum 15 Sep. 1978 43 p refs
(NR Proj. 389-923)
(AD-A060084; TR-178) Avail: NTIS HC A03/MF A01 CSCL 20/4

An analysis of two aspects of air bubble nucleation is presented. Part I describes the role of particulate matter in acoustic cavitation inception; Part II describes the growth of air bubbles by rectified diffusion in insonated root tips. It was discovered that a modification of some earlier analyses of cavity nucleation from motes leads to a correct prediction of the variation of the acoustic cavitation inception threshold for kilohertz frequencies in water for a range of physical variables. It was also discovered that acoustic emissions from insonated root tips could be attributed to the growth of air bubbles by rectified diffusion. Author

N79-15273# Rochester Univ., N. Y. Dept. of Electrical Engineering.
CAVITATION DYNAMICS. 4: COLLAPSE OF TRANSIENT CAVITIES
H. G. Flynn 28 Jul. 1978 21 p refs
(Contract N00014-76-C-1080)
(AD-A060895) Avail: NTIS HC A02/MF A01 CSCL 20/4

Calculations have been made of the maximum pressures and temperatures that may occur in collapsing argon bubbles in water through use of a previously developed mathematical formulation (J. Acoust. Soc. 57, 1379-1396 (1975)). Equation-of-state data valid for water and argon at high pressures were introduced into the formulation in an effort to determine upper bounds of such maximum pressures and temperatures. The limitation imposed on pressures and temperatures in collapsing bubbles by growing perturbations on spherical interfaces was also studied. Author (GRA)

N79-15274# Purdue Univ., Lafayette, Ind. Project SQUID Headquarters.
AN EXPERIMENTAL STUDY OF THE TRANSPORT OF A NON-DIFFUSIVE SCALAR CONTAMINANT IN THE DECAYING TURBULENCE FIELD OF AN ENCLOSED CHAMBER Final Report
K. C. Cornelius (Michigan State Univ., East Lansing) and J. F. Foss (Michigan State Univ., East Lansing) Aug. 1978 116 p refs Prepared by Michigan State Univ., East Lansing
(Contract N00014-75-C-1143; Proj. SQUID; NR Proj. 098-038)
(AD-A060463; SQUID-MSU-1-PU) Avail: NTIS HC A06/MF A01 CSCL 20/4

An experimental investigation of the convective properties of a turbulence field within a closed mixing chamber has been executed; the investigation is supported by appropriate theoretical analyses. The purposes of the study were (1) to develop an experimental technique which could ascertain the convective, or dispersive, properties of such a turbulence field (i.e., with the constraint of zero molecular diffusivity); and (2) to document the influence of the Reynolds number on the convective transport properties of a representative field. GRA

N79-15275# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
IMPACT BEHAVIOR OF LOW STRENGTH PROJECTILES Final Report, 1 Jul. 1974 - 31 May 1977
James S. Wilbeck Jul. 1978 129 p refs
(AD-A060423; AFML-TR-77-134) Avail: NTIS HC A07/MF A01 CSCL 19/4

An unsteady, hydrodynamic model of the impact of a low strength projectile on a rigid or semi-rigid target has been developed. Impact tests of various materials including birds, gelatin, and RTV rubber have been conducted to validate this theory. At velocities above 100 m/s, these materials were seen to flow as a fluid upon impact. The resulting impact pressure histories were very similar to those predicted using the model. The impact process was dominated by an initial shock phase which was quickly followed by a release to a steady flow condition. This model should be applicable to the impact of any material for which the shock pressures generated during impact are much greater than the strength of the projectile but are less than the strength of the target. Author (GRA)

N79-15276# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Mathematical Sciences.
EFFECT OF A CORIOLIS FORCE ON THE STABILITY OF PLANE POISEUILLE FLOW
J. E. Flaherty and R. C. DiPrima Oct. 1977 17 p refs Repr. from the Phys. of Fluids, v. 21, no 5, 1978 p 718-726
(Contract N00014-76-C-0187; Grant DAAG29-76-G0315)
(AD-A059113) Avail: NTIS HC A02/MF A01 CSCL 20/4

The stability of the viscous flow between two parallel horizontal plates due to a constant reduced pressure gradient in a system rotating about a vertical axis is studied. The critical value of the Reynolds number R, based on the reduced pressure gradient, is a function of a dimensionless rotation parameter T, the Taylor number. A numerical solution of the eigenvalue problem shows that the minimum point for the viscous instability mode associated with plane Poiseuille flow at T=0 disappears at a value of T of about T approximately equal to 0.4, and for T not equal to 0 a new instability mode appears as a result of the Coriolis effect on the basic flow and in the perturbation equations. This new instability gives the critical value of R for values of T as small as 0.06. Author

N79-15277# Rochester Univ., N. Y. Acoustical Physics Lab.
CAVITATION DYNAMICS. 3: THRESHOLDS AND THE GENERATION OF TRANSIENT CAVITIES
H. G. Flynn 25 Jul. 1978 17 p refs
(Contract N00014-76-C-1080)
(AD-A060518) Avail: NTIS HC A02/MF A01 CSCL 20/4

Dynamics of small argon bubbles under the influence of an acoustic pressure field have been studied using a mathematical formulation derived previously (J. Acoust. Soc. 57, 1379-1396 (1975)). Calculation of the maximum pressure in a collapsing bubble and work done by expanding bubbles show there are two cavitation pressure thresholds -- one for the onset of cavitation activity and the other for a decrease in cavitation activity. Author (GRA)

N79-15278# Ballistic Research Labs., Aberdeen Proving Ground, Md. Ballistic Research Lab.
ONE, TWO, AND THREE-DIMENSIONAL IMPACT COMPUTATIONS Final Technical Report
V. Kucher Aug. 1978 92 p
(AD-A060611; AD-E430115; ARBRL-TR-02099) Avail: NTIS HC A05/MF A01 CSCL 19/4

A one-dimensional impact problem was run on a computer to determine the characteristics of the DORF-9 code. This code, in a two-dimensional, axisymmetric mode, was used to study the penetration of a 25.5-mm steel plate by a copper, shaped-charge jet, which was simulated by a 6-mm, semi-infinite, copper rod impacting normally on the plate at 7.5 km/s. This problem was also simulated by a plate-on-plate impact with the code operating in a two-dimensional, Cartesian mode. The thickness of the penetrator plate was varied. Penetration, hole growth and shape, shock-wave propagation, and spallation were compared for the rod and penetrator plates. The TRIDORF code was used in a three-dimensional, Cartesian mode to run a problem of a bar impacting on a plate. Comparisons were made between the rod and bar impacts. Author (GRA)

N79-15279# Stanford Research Inst., Menlo Park, Calif.
THEORETICAL STUDIES OF DETONATION WAVES Final Report, Jun. 1971 - Mar. 1974

Michael Cowperthwaite, Craig M. Tarver, and Clarence M. Ablow Aug. 1978 58 p refs
(Contract DAAD05-71-C-0363)
(AD-A060614; AD-E430117; ARBRL-CR-00377) Avail: NTIS HC A04/MF A01 CSCL 19/4

Theoretical studies of reactive shock waves were performed to obtain a fundamental understanding of the initiation and propagation of detonation in condensed explosives. The differential equation governing a shock discontinuity was used to determine different conditions associated with a single shock trajectory for build-up to detonation. One of these conditions was used to construct the type of flow observed in PBX 9404 during the early stages of initiation produced by a flying plate. Various aspects of initiation induced by a constant velocity piston were considered. Equations relating the initial flow to the initial energy release rate were derived. Conditions were also determined for the shock to accelerate with either a positive or a negative pressure gradient. These conditions demonstrate how the mechanism of initiation depends on the energy release rate, the sound speed, and on the relationship between these quantities. A critical energy was defined for waves that build up to detonation with a positive particle velocity gradient. Work on the reactive shock problem was continued and integral relationships for unsteady flow were derived as generalized Rankine-Hugoniot equations without making approximations. GRA

N79-15280# Hess (John L.) Associates, Long Beach, Calif.
ON THE SOLUTION OF NONLINEAR FREE-SURFACE PROBLEMS BY SURFACE-SINGULARITY TECHNIQUES Final Technical Report, Oct. 1975 - Jan. 1978
John L. Hess 10 Jul. 1978 43 p refs
(Contract N00014-76-C-0337)
(AD-A060766; FTR-2) Avail: NTIS HC A03/MF A01 CSCL 20/4

This report describes an attempt to solve the two-dimensional problem of a body performing steady translation near a free surface. The aim was to solve the problem in its full generality without any linearizations or small-perturbation assumptions. The method of solution is based on iterative use of the well-known surface singularity technique and thus, if successful, the method could be generalized to three dimensions. At each stage of the procedure the free-surface shape is assumed known and the singularity strength adjusted to satisfy the constant-pressure boundary condition. In general, the normal velocity on the free surface is not zero. The free-surface shape is then altered by some algorithm, and the procedure is iterated to obtain zero normal velocity. The key to approach is the iterative algorithm. Various algorithms were tested by applying them to the problem of a submerged point vortex and comparing the free-surface shape obtained in convergent cases with published results. After considerable experimentation, a procedure was devised that gives very good results as long as the wave heights are not too large. For large wave heights, convergence could not be obtained, and some as yet undiscovered change in the method is needed. Author (GRA)

N79-15281# Naval Research Lab., Washington, D. C. Ocean Technology Div.
VORTEX-EXCITED UNSTEADY FORCES ON RESONANTLY VIBRATING, BLUFF STRUCTURES Final Report
Owen M. Griffin Aug. 1978 43 p refs
(AD-A060710; AD-E000231; NRL-MR-3820) Avail: NTIS HC A03/MF A01 CSCL 20/4

This report considers recent experimental findings pertaining to the vortex-excited oscillations of bluff cylinders, and compares various approaches to measuring the resultant fluid forces. As one example, measurements of the structural damping and crossflow response amplitudes were made for several systems over a representative range of wind tunnel flow speeds. The fluid dynamic damping or reaction in-phase with the cylinder's velocity also was measured for different incident flow speeds over a range which included the locking-on of the vortex shedding to the resonant cylinder vibrations. A mathematical model is proposed in connection with these measurements, and the components of the excitation or lift force on a vibrating structure can be obtained from the model once the structural damping and fluid reaction forces are known. In a second approach, the fluid forces were measured on a cylinder which was forced to oscillate in water at different frequencies and crossflow amplitudes over a range of incident flow speeds. Both the steady and unsteady forces are altered significantly in the locking-on regime, with large amplifications in both the lift and drag. These vortex-excited forces are then incorporated into the mathematical model for self-excited, resonant vibrations and the complementary nature of the two measurement schemes is discussed. The results obtained from the present study are suitable in general for application not only to the vortex-excited vibrations of rigid cylinders, but also to other flexible bluff structures and cables in air and in water. Author (GRA)

N79-15282# Iowa State Univ. of Science and Technology, Ames. Heat Transfer Lab.
PREDICTION OF TURBULENT JETS AND PLUMES IN FLOWING AMBIENTS
S. S. Hwang and R. H. Pletcher Aug. 1978 135 p refs
(Grant NSF-ENG-74-22193; ERI Proj. 1201; ERI Proj. 2213)
(PB-286980/8; ISU-ERI-AMES-79003) Avail: NTIS HC A07/MF A01 CSCL 20D

A differential approach for the analysis of the behavior of turbulent, axisymmetric buoyant jets and plumes discharged into a crossflowing ambient is presented. The thin shear layer form of the governing partial differential equations for the conservation of mass, momentum and energy, derived in a curvilinear, orthogonal coordinate system is solved numerically by a fully implicit finite difference technique. A 'lumped' analysis is proposed to simplify the momentum equation in the transverse direction. The turbulent shear stress and heat flux terms appearing in the governing equations are evaluated through turbulent viscosity and conductivity models which contain parameters related to buoyancy and streamline curvature. GRA

N79-15283# National Technical Information Service, Springfield, Va.
CASCADE FLOW, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1974 - Nov. 1978
Guy E. Habercom, Jr. Dec. 1978 223 p Supersedes NTIS/PS-77/1117; NTIS/PS-76/1001; NTIS/PS-75/878 (NTIS/PS-78/1239/9; NTIS/PS-77/1117; NTIS/PS-76/1001; NTIS/PS-75/878) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 20D

The bibliography continues the materials begun in the previous volume on the fluid dynamics of cascades and cascade structures. The general coverage is the same: turbomachinery elements, supersonic and axial flow compressors, turbojet and turbofan inlet characteristics, airfoils, hydrofoils, jet engines, turbocompressor boundary layers, torque converters, thrust reversers, tandem structures, and similar applications. Discussions are presented of aero-dynamic aspects, cascade wind tunnels and testing programs, secondary flow, blade dynamics, and film cooling. Mathematical models and computer programs are described. Speed regimes range from subsonic through hypersonic. This updated bibliography contains 218 abstracts, 47 of which are new entries to the previous edition. GRA

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N79-15284*# IBM Federal Systems Div., Gaithersburg, Md.
RADIOMETRIC CORRECTION PROCEDURE STUDY Final Report, Sep. 1977 - Jun. 1978
C. Colby, R. Sands, and S. Murphrey Jun. 1978 159 p
(Contract NAS5-24276)
(NASA-CR-159904; FSD-78-0015) Avail: NTIS HC A08/MF A01 CSCL 14B

A comparison of MSS radiometric processing techniques identified as a preferred radiometric processing technique a

procedure which equalizes the mean and standard deviation of detector-specific histograms of uncalibrated scene data. Evaluation of MSS calibration data demonstrated that the relationship between detector responses is essentially linear over the range of intensities typically observed in MSS data, and that the calibration wedge data possess a high degree of temporal stability. An analysis of the preferred radiometric processing technique showed that it could be incorporated into the MDP-MSS system without a major redesign of the system, and with minimal impact on system throughput. Author

N79-15285# Systems Science and Software, La Jolla, Calif.
DEVELOPMENT OF AIRBLAST AND THERMAL RADIATION INSTRUMENTATION Final Report, 16 Aug. 1976 - 31 Mar. 1978
H. R. Kratz 31 Mar. 1978 80 p refs
(Contract DNA001-76-C-0365)
(AD-A060432; SSS-R-78-3635; DNA-4594F) Avail: NTIS HC A05/MF A01 CSCL 14/2

This is part of a continuing effort to develop instrumentation for use in underground nuclear tests. In particular, the development of instrumentation to measure airblast and thermal radiation is described. The initial development of an instrumented sphere to measure dynamic pressure in the supersonic flow behind a blast front was completed. Experiments are described that show that it is feasible to use a bar gauge to measure pressure on a surface parallel to the axis of the bar gauge by using a piston and fluid coupling combination. Work is described on sputtering a thin (2 micron) insulating film of sapphire onto the surface of a copper disc. Such films are required in a proposed thermal radiation gauge to measure the total radiation flux in an underground nuclear explosion. Measurements of pressure in the HE driver chamber on the DABS S-2 Test are also described.
Author (GRA)

N79-15286# Defence Research Establishment Valcartier (Quebec).
DIGITAL RESTORATION OF BLURRED PHOTOGRAPHS
J. F. Boulter Feb. 1978 67 p refs
(AD-A053107; DREV-R-4107/78) Avail: NTIS HC A04/MF A01 CSCL 14/5

The amount of information that a human observer can obtain from a blurred photograph can be increased by post-processing the image in a digital computer. A complete procedure for restoring (by Wiener filtering) high-resolution photographs degraded by several common types of blurs is described. The practical aspects of obtaining an acceptable restoration are considered in detail. These include the limitations of the Wiener filter, the characteristics of photographic film and methods to identify the blur by analyzing the blurred image using only limited a priori knowledge. High-resolution photographs degraded by motion and focus blurs introduced directly in a camera are restored to illustrate the techniques. Author (GRA)

N79-15287# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
AUTOMATIC TEST EQUIPMENT SOFTWARE LIFE CYCLE COST SIMULATION MODEL VALIDATION M.S. Thesis
Frederick V. Novak and Henry Winters, Jr. Jun. 1978 150 p refs
(AD-A059182; AFIT-LSSR-16-78A) Avail: NTIS HC A07/MF A01 CSCL 14/2

A model is validated that was developed to aid managers in predicting acquisition and support costs of Automatic Test Equipment (ATE) software. The validation effort used the method of differences for coding nominal level data obtained from interviews of software programmers, and analysis of variance and multiple linear regression to derive a relationship between a manhours correction factor, the dependent variable, and language, documentation, and training, the independent variables. Outputs of the model were compared against manhours from historial data on ATE software in the C-5A, B-52, F-111, and F-4 weapon systems. The model's systems parameters were updated, model outputs were changed using FORTRAN statements, and all tables were graphed. Model control cards were changed for compatibility with General Purpose Simulation System 6000 version 2 on the CREATE computer system. The model's predictive capability was good good only to a 30% accuracy.
G.G.

N79-15288# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
THE MICROPHYSICAL BASIS OF FOG OPTICAL CHARACTERIZATION
Richard D. Low, Louis D. Duncan, and Richard B. Gomez Aug. 1978 39 p refs
(DA Proj. 1L1-62111-AH-71)
(AD-A059691; ERADCOM/ASL-TR-0011) Avail: NTIS HC A03/MF A01 CSCL 14/2

The increasing use by the Army of the various types of electro-optical devices necessitates a test and evaluation program to determine the performance of these devices under a variety of weather conditions, the foggy condition, in particular. The presence of fogs seriously degrades the effectiveness of visible and infrared sensors. It would be impractical as well as uneconomical to test and evaluate each device individually under different atmospheric conditions. A more logical and direct approach would be to characterize and develop physical and optical models of fogs through extensive microphysical, meteorological, and spectral measurements at selected spectral regions, locations, and at different periods of fog evolution. This report presents a brief review of the state of fog microphysics. Author

N79-15289# Aberdeen Proving Ground, Md. Materiel Testing Directorate.
RESEARCH AND DEVELOPMENT OF INSTRUMENTATION PROGRAM EVALUATION OF BREADBOARD PROJECTILE AIRBURST AND IMPACT LOCATING SYSTEM (PAILS) Final Report, 6 Jan. 1975 - 8 May 1978
Jun. 1978 46 p refs
(AD-A059197; APG-MT-5118) Avail: NTIS HC A03/MF A01 CSCL 17/9

The Projectile Airburst and Impact Locating System (PAILS) is a concept utilizing a trilateration radar network to locate the positions of airburst or ground impacts of artillery or mortar projectiles at proving-ground installations. This report describes tests conducted on a single breadboard radar. A description of the radar and its specifications is provided. Measurement of static and dynamic performance is described. It is concluded that: sufficient data are not available to assess the capability of the PAILS concept; the cause of the inability of the breadboard PAILS to lock-up on the terminal portion of the trajectory is unknown; additional tests of the breadboard PAILS will require 5,000 to 7,500 man-hours over a 1 year period; the risk is high that additional tests would not provide the required data; the payoff for TECOM test ranges is minimal; further testing is neither prudent nor justifiable. It is recommended that an alternative scoring approach be utilized. Author

N79-15290# Oak Ridge National Lab., Tenn. Engineering Technology Div.
ADVANCED TWO-PHASE INSTRUMENTATION PROGRAM Quarterly Progress Report, Apr. - Jun. 1977
W. H. Leavell, P. H. Hayes, P. A. Jallouk, F. Shahrokhi, and C. O. McNew Dec. 1977 19 p refs
(Contract W-7405-eng-26)
(ORNL-NUREG/TM-140) Avail: NTIS HC A02/MF A01

A conductivity probe system consisting of two identical electrode assemblies 25 mm apart and rotated 90 deg with respect to each other was tested in an air-water loop at void fractions of 3 and 40%. Relatively high coherence was obtained between the two electrode assemblies. The velocity measurements obtained from the experimentally determined phase shift curves were in reasonable agreement with those calculated from general two phase flow principles. DOE

N79-15291# National Ocean Survey, Rockville, Md. Test and Evaluation Lab.
THE VERTICAL PLANAR MOTION MECHANISM: A DYNAMIC TEST APPARATUS FOR EVALUATING CURRENT METERS AND OTHER MARINE INSTRUMENTATION
A. N. Kalvaitis Jul. 1978 47 p
(Contract EPA-IAG-D5-E693)
(PB-286571/5; EPA-600/7-78-145) Avail: NTIS HC A03/MF A01 CSCL 14B

A dynamic test apparatus is provided that can produce known, controlled high frequency dynamics for the evaluation of current meters and other marine instrumentation. Of primary interest is the establishment of flow sensor measurement capabilities, and hence, data quality in an unsteady flow environment. The culmination of this development is a Vertical Planar Motion Mechanism (VPMM) that generates three major modes of dynamics--vertical circular, vertical and horizontal--at length scales from .15 to 1.22 meters and time scales from 5 to 12 seconds. The VPMM mounts on a tow carriage which provides the steady velocity while the VPMM superimposes oscillatory motions on full size current meters. The VPMM is instrumented such that the instantaneous velocities of the test sensors and their outputs may be measured at a 20Hz sampling rate; an on-board computer allows for near-real time data analysis. GRA

N79-15219# Joint Publications Research Service, Arlington, Va.
ON THE QUESTION OF IMMERSED RADIATION DETECTORS
P. T. Ivanov, I. L. Anitropova, and Yu. S. Levitin *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 56 (JPRS-72448) 14 Dec. 1978 p 17-21 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Proborostr. (Moscow), no. 9, Sep. 1978 p 108-112 (For primary document see N79-15218 06-31)
Copyright. Avail: NTIS HC A04/MF A01

N79-15564# Arizona Univ., Tucson. Radiation Oncology Div.
THERMOMETRY IN STRONG ELECTROMAGNETIC FIELDS
T. C. Cetas *In* Bur. of Radiological Health The Phys. Basis of Electromagnetic Interactions with Biol. Systems Apr. 1978 p 261-281 refs (For primary document see N79-15551 06-51) (Contract FDA-221-76-0189; Grants CA-17343; FD-03189-76)
Avail: NTIS HC A18/MF A01

N79-15565# Office National d'Etudes et de Recherches Aerospatiales, Toulouse (France). Microwave Dept.
NON-PERTURBING MICROPROBES FOR MEASUREMENTS IN ELECTROMAGNETIC FIELDS
A. Deficis and A. Priou *In* Bur. of Radiological Health The Phys. Basis of Electromagnetic Interactions with Biol. Systems Apr. 1978 p 283-293 refs (For primary document see N79-15551 06-51)
Avail: NTIS HC A18/MF A01

N79-15566# Illinois Univ., Urbana-Champaign.
THE VISCOMETRIC THERMOMETER
Charles A. Cain, Michael M. Chen, Katherine Loh Lam, and Jeffrey Mullin *In* Bur. of Radiological Health The Phys. Basis of Electromagnetic Interactions with Biol. Systems Apr. 1978 p 295-308 refs (For primary document see N79-15551 06-51)
Avail: NTIS HC A18/MF A01

N79-15568# Bureau of Radiological Health, Rockville, Md.
DESIGN AND STANDARDIZATION OF EXPOSURE SYSTEMS FOR RF AND MICROWAVE EXPERIMENTATION
Mays L. Swicord and Henry S. Ho *In its* The Phys. Basis of Electromagnetic Interactions with Biol. Systems Apr. 1978 p 327-358 refs (For primary document see N79-15551 06-51)
Avail: NTIS HC A18/MF A01

N79-15569# Bureau of Radiological Health, Rockville, Md.
CALIBRATION TECHNIQUES FOR MICROWAVE AND RF EXPOSURE MEASUREMENT DEVICES
Howard I. Bassen *In its* The Phys. Basis of Electromagnetic Interactions with Biol. Systems Apr. 1978 p 359-382 refs (For primary document see N79-15551 06-51)
Avail: NTIS HC A18/MF A01

36 LASERS AND MASERS

Includes parametric amplifiers.

N79-15292*# Illinois Univ., Urbana. Radio Research Lab.
A TECHNIQUE FOR REMOTELY MEASURING SURFACE PRESSURE FROM A SATELLITE USING A MULTICOLOR LASER RANGING SYSTEM
C. S. Gardner Jan. 1979 28 p refs
(Grant NsG-5049)
(NASA-CR-158062; RRL-Publ-499) Avail: NTIS HC A03/MF A01 CSCL 20E

The optical path length from a satellite to the earth's surface is strongly dependent on the atmospheric pressure along the propagation path. Surface pressure can be measured by using a multicolor laser ranging system to observe the change with wavelength in the optical path length from the satellite to a ground target. The equations which relate surface pressure to the differential path lengths are derived and the accuracy of the pressure measurement is evaluated in terms of the ranging system parameters. The results indicate that pressure accuracies of a few millibars appear feasible. Author

N79-15293# Arizona Univ., Tucson. Dept. of Physics.
STUDIES OF EXTINCTION BY SMALL PARTICLES IN THE 10 MICRON SPECTRAL REGION
Donald R. Huffman Jul. 1978 42 p refs
(Contract N00019-77-C-0293)
(AD-A060443) Avail: NTIS HC A03/MF A01 CSCL 17/4

With the increasing importance of lasers in our technological world and the continually increasing power levels becoming available, it is inevitable that laser weapons will play an important role in various phases of modern warfare. As dependence on lasers increases, there is a need to know how these intense light beams are affected by airborne particles, either intentionally or accidentally produced, whether man-made or natural. Obvious defensive mechanisms against laser weapons might include smoke screens, i.e., high concentrations of particles selected to effectively stop certain laser wavelengths. Against this background of laser development, this study has begun to examine the processes by which laser light is attenuated through interaction with a collection of small particles. GRA

N79-15294# Maryland Univ., College Park. Dept. of Physics and Astronomy.
CYCLOTRON MASER INSTABILITY FOR GENERAL MAGNETIC HARMONIC NUMBER
Hwan-sup Uhm, Ronald C. Davidson (DOE, Washington, D. C.), and K. R. Chu (Naval Research Lab., Washington, D. C.) 1978 40 p refs
(Contract N00014-75-C-0309)
(AD-A060379; Pub-78-132) Avail: NTIS HC A03/MF A01 CSCL 20/5

This paper examines the cyclotron maser instability for general magnetic harmonic number transverse electric (TE) and transverse magnetic (TM) waveguide modes in a conducting cylinder of radius R sub c. The analysis is carried out for a hollow electron beam (radius R sub 0) propagating parallel to a uniform axial magnetic field. One of the most important features of the analysis is that the instability growth rate for magnetic harmonic numbers s=2, 3, ... is comparable to the growth rate of the fundamental (s=1) mode, particularly for moderate electron energy. Moreover, it is shown that the instability growth rate can be maximized by appropriate choice of the geometric parameter R sub 0/R sub c. GRA

N79-15295# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
WATER VAPOR ABSORPTION COEFFICIENTS AT HF LASER WAVELENGTHS. PART 1: ATMOSPHERIC CONDITIONS CORRESPONDING TO ALTITUDES UP TO 7 km
W. R. Watkins, Robert L. Spellicy, Kenneth O. White, Brian L. Sojka, and Lanny R. Bower May 1978 104 p refs
(DA Proj. 1L1-61102-B-53A)
(AD-A059969; ERADCOM/ASL-TR-0007-Pt-1) Avail: NTIS HC A06/MF A01 CSCL 04/1

Water vapor absorption measurements are reported at nine HF laser wavelengths ranging from P sub 3-2 (5) at 3418.1600/cm to P sub 1-0 (4) at 3788.2253/cm. The results were obtained with a temperature controlled longpath absorption

cell and a path differencing technique with path differences ranging from 8 to 152 m. Cell temperatures ranging from -18 to 25 C were used. Pure water vapor as well as air (N2/O2) broadened water vapor absorptions were measured for pressures ranging from less than 1 torr to 764 torr. Limited data on O2 broadened water vapor absorption as well as pure and air broadened CO2 absorption are presented. In general the air broadened water vapor results show more absorption than predicted and imply a 'super' Lorentz or Voigt line shape. The pure O2 broadened water vapor absorption is less than the air broadened absorption. New self- and foreign-broadening coefficients are obtained. Finally, the limited CO2 absorption observed shows good agreement with theoretical predictions. These results will allow more accurate modelling of atmospheric transmission for EO and HEL applications. Author (GRA)

N79-15296# Wisconsin Univ., Madison. Dept. of Chemistry.
METHYL ISOCYANIDE PHOTODISSOCIATION: CHEMICAL LASER DETERMINATION OF ENERGY PARTITIONING INTO THE CYANIDE RADICAL PHOTOCHEMICAL PRODUCT
J. Thomas Knudtson and Michael J. Berry Dec. 1977 14 p refs Repr. from J. Chem. Phys., v. 68, no. 10, 15 May 1978
(Grant AF-AFOSR-2644-74; AF Proj. 2303)
(AD-A059323; AFOSR-78-1327TR) Avail: NTIS HC A02/MF A01 CSCL 20/5

Chemical laser techniques were used to study the photodissociative excitation of cyanide Radical by photolysis of methyl isocyanide and to identify efficient spin-orbit relaxation of cyanide radical between its manifolds. Many new chemical laser transitions were obtained within the cyanide radical 0.0 red band by selective cavity Q spoiling with a diffraction grating. Measurements of the relative gain coefficients of grating-tuned laser transitions and the observed cyanide radical product state distribution signify that strong dynamical effects govern the process of photodissociative excitation are discussed. J.M.S.

N79-15297# Xonics, Inc., Van Nuys, Calif.
OPTICAL GAIN MEASUREMENTS AND DEVELOPMENT STUDIES OF VISIBLE CHEMICAL LASER SYSTEMS Final Report
Stanley E. Johnson and Paul B. Scott 31 Aug. 1978 146 p refs
(Contract N00173-76-C-0301; ARPA Order 2062)
(AD-A060447) Avail: NTIS HC A07/MF A01 CSCL 20/5

Chemiluminescence spectra and laser cavity gain measurements have been made on chemical reactions thought to have promise for visible lasing. A shock tunnel apparatus capable of producing hot flows for periods of milliseconds was used for the experiments. Group II metals (magnesium, strontium and calcium) reacted with carbon monoxide and nitrous oxide resulted in bright band chemiluminescence, and low excited state yields. The low yields appear to be due to electronic state quenching. A new ultraviolet band of MgO was observed. Magnesium-Fluorine reactions repeated the previously observed abnormal population distributions, but no significant laser gain was observed. Xenon excimer radiation resulting from chemical reaction was observed to be very bright, and possible laser gain was implied by the relative intensities of the output light polarized normal and parallel to the Brewster window axes. Diatomic excited sulfur B-X radiation from chemical reactions was observed in detail, but no gain was observed. GRA

N79-15298# Rockwell International Corp., Anaheim, Calif. Electronics Research Center.
OPTICAL PULSE COMPRESSION FOR LASER RADAR AND COMMUNICATIONS Final Scientific Report, 1 Jul. 1977 - 30 Jun. 1978
J. D. McMullen 31 Aug. 1978 52 p refs Submitted for publication
(Contract F49620-77-C-0109; AF Proj. 2305)
(AD-A060412; C78-947/501) Avail: NTIS HC A04/MF A01 CSCL 20/5

The classical theory for compression of optical pulse in linear, dispersive media has been generalized to include a carrier frequency which varies quadratically as well as linearly with time. The nonlinearly chirped pulse becomes temporarily compressed upon propagating through a strongly dispersive medium. The group delay in the strongly dispersive propagation medium varies quadratically with carrier frequency. This theory has been applied to an experimental configuration of two gratings oriented to give strong dispersion of group delay. Objectives are to determine the influence of strong dispersion upon the shape and width of the compressed pulse. Results indicate that a grating-pair delay medium is feasible which is capable of compressing a linearly chirped 88 ns wide pulse at 10.6 micrometers wavelength to a final width of 0.8 ns. However, strong dispersion does distort the envelope of the compressed pulse so that it is no longer strictly the Fourier transform of the envelope of the original pulse. Addition of a nonlinear chirp to the incident pulse, in the form of a quadratic change in carrier frequency with time, causes the output to be broken into a series of pulses. The sub-pulses in this series are much narrower than the incident pulse, and exhibit increasingly larger gain in peak intensity over the incident pulse toward the end of the pulse train. Author (GRA)

N79-15299# Joint Inst. for Lab. Astrophysics, Boulder, Colo.
RESEARCH IN LASER PROCESSES Semiannual Report, 1 Feb. 1978 - 31 Jul. 1978
A. V. Phelps and A. C. Gallagher 22 Sep. 1978 17 p refs
(Contract N00014-76-C-0123; ARPA Order 2683)
(AD-A060761) Avail: NTIS HC A02/MF A01 CSCL 20/5

The modeling of electrical discharges in high pressure Na-Xe mixtures for high power laser applications was extended to include stimulated emission by incident radiation at the wavelength of the excimer band. In addition, the effects of the use of very high sodium densities and of changes in the products of dissociative recombination was explored. It was concluded that an efficient laser amplifier would result if one could find an excimer mixture with favorable products of dissociative recombination. The experimental evaluation of metal vapor-rare gas mixtures was extended to include Mg-Xe mixtures. Stable discharges were obtained similar to those in Na-Xe mixtures. An apparent excimer band extended far to the red side of the resonance line of Mg at 285 nm. The large extent of this red wing suggests that it will be relatively easy to obtain gain using the Mg-Xe mixture. It remains to be seen whether the gain will be large enough to be useful and as to whether there are interfering absorption bands. GRA

N79-15300# Brookhaven National Lab., Upton, N. Y.
NEW LASER AEROSOL DETECTOR AND MONITOR FOR USE OF HIGH PRESSURE GAS STREAMS
W. E. Harrison, Jr., Frederick M. Shofner (Process Particulate Monitors, Inc., Knoxville, Tenn.), and Arthur C. Miller, Jr. (Process Particulate Monitors, Inc., Knoxville, Tenn.) 1977 22 p refs Presented at Cryogenic Eng. Conf., Boulder, Colo., 2-5 Aug. 1977 Sponsored by DOE
(BNL-22929; Conf-770801-21) Avail: NTIS HC A02/MF A01

A new laser particulate detection instrument is described which continuously measures the level of particulate matter and oil aerosols directly in a high pressure gas stream. It was developed to monitor, in situ, helium at 15 atmospheres that is used in a cryogenic refrigerator. The instrument uses forward scattering of laser light to detect particulate matter and accomplishes high sensitivity and stability by using unique automatic compensation of the entire electro-optical trains. DOE

N79-15301# Illinois Univ. at Urbana-Champaign, Urbana. Electro-Physics Lab.
ELECTRON BEAM CONTROLLED GAS LASERS Interim Report, 15 Jan. 1977 - 15 Jan. 1978
T. A. Detemple Jul. 1978 25 p refs
(Grant NSF-ENG-75-21515)
(PB-287119/2; UILU-ENG-78-2547) Avail: NTIS HC A02/MF A01 CSCL 20E

An experimental and theoretical investigation of Xe laser transitions in high pressure electron beam initiated discharges in Ar-Xe mixtures is summarized. The significant experimental features include an overall conversion efficiency of 1.3 percent, including deposited beam energy, the dominant line being 1.73 micrometers, and an optimum operating pressure of 2.5 atmospheres. The dominant kinetics point towards an energy recirculation from metastable Xe involving dissociated recombination pumping, cascade pumping and possible contributions from

direct excitation from levels lower than the upper laser state. GRA

N79-15302# Stanford Univ., Calif. High Energy Physics Lab.
AN APPROXIMATE TECHNIQUE FOR THE INTEGRATIONS OF THE EQUATIONS OF MOTION IN A FREE ELECTRON LASER (FEL). ONE DIMENSIONAL MONTE CARLO ANALYSIS OF A FREE ELECTRON LASER (FEL). IN A STORAGE RING Final Report, May - Jun. 1977
J. M. J. Madey, D. A. G. Deacon, L. R. Elias, and T. I. Smith Sep. 1978 37 p refs
(Contract DASG60-77-C-0083)
(AD-A060465; SU-HEPL-819; SU-HEPL-824) Avail: NTIS HC A03/MF A01 CSCL 20/5

The final report for this contract consists of two articles submitted for publication in the open literature. In the first article the authors describe an approximation they have used to compute gain, saturation, and electron statistics for a free electron laser. In the second article they report the results of a Monte Carlo method one-dimensional analysis of the equilibrium energy spread, bunch length, and average energy radiated by electrons in a storage ring free electron laser. Author (GRA)

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N79-15303# Naval Air Propulsion Test Center, Trenton, N.J.
ADVANCED GEAR STEELS AND LUBRICANTS FOR IMPROVED GEAR TOOTH SCUFFING/SCORING RESISTANCE FOR AIRCRAFT APPLICATIONS Propulsion Technology and Project Engineering Dept.
Daniel Popgoshev Aug. 1978 24 p refs
(AD-A060911; NAPC-PE-10) Avail: NTIS HC A02/MF A01 CSCL 01/3

Two advanced gear materials (Timken CBS 1000M and Carpenter Cartech EX00014) and an AMS 6260 gear material were evaluated in combination with three lubricants (unformulated basestock ester, a qualified MIL-L-23699B, and an XAS-2354 lubricant) to determine their gear scuffing/scoring capacities. The results show that (1) the CBS 1000M steel is superior to AMS 6260 with the lubricants evaluated; (2) the EX00014 steel is superior to the AMS 6260 with the formulated lubricants; and (3) the XAS-2354A lubricant showed significant load carrying capacity improvements for all three gear steels. Author (GRA)

N79-15304# Department of Energy, Bartlesville, Okla. Energy Research Office.
PERFORMANCE CHARACTERISTICS OF AUTOMOTIVE ENGINES IN THE UNITED STATES. FIRST SERIES: REPORT NO. 14 1975 MAZDA ROTARY 79 CID (1.1 LITERS), 4V Interim Report, Jul. 1977
W. F. Marshall and K. R. Stamper May 1978 40 p
(PB-286074/0; BERC/OP-76/32; Rept-14; DOT-TSC-NHTSA-78-8; DOT-HS-803324) Avail: NTIS HC A03/MF A01 CSCL 21G

Experimental data were obtained in dynamometer tests of a 1975 Mazda 70 CID, 4V rotary engine to determine fuel consumption and emissions (hydrocarbon, carbon monoxide oxides of nitrogen)at steady-state engine-operating modes. Engine performance data for estimating emissions and fuel economy for varied engine service and duty were acquired to prove basic engine characteristic data required as input for engineering calculations involving ground transportation. GRA

N79-15305# Department of Energy, Bartlesville, Okla. Energy Research Center.
PERFORMANCE CHARACTERISTICS OF AUTOMOTIVE ENGINES IN THE UNITED STATES. FIRST SERIES: REPORT NO. 15 1975 DODGE COLT 98 CID (1.6 LITERS), 2V Interim Report, Aug. 1977
T. W. Chamberlain, D. E. Koehler, K. R. Stamper, and W. F. Marshall May 1978 41 p
(PB-286075/7; BERC/OP-77/42; DOT-TSC-NHTSA-78-9; DOT-HS-803325) Avail: NTIS HC A03/MF A01 CSCL 21G

Experimental data were obtained in dynamometer tests of a 1975 Dodge Colt 1.6 liter (98 CID) engine to determine fuel consumption and emissions (hydrocarbon, carbon monoxide, oxides of nitrogen) at steady-state engine-operating modes. Engine performance data for estimating emissions and fuel economy for varied engine service and duty were acquired to provide basic engine characteristic data required as input for engineering calculations involving ground transportation. GRA

N79-15306# Department of Energy, Bartlesville, Okla. Energy Research Center.
PERFORMANCE CHARACTERISTICS OF AUTOMOTIVE ENGINES IN THE UNITED STATES. SECOND SERIES: REPORT NO. 5 1977 FORD 140 CID (2.3 LITERS), 2V Interim Report, Nov. 1977
T. W. Chamberlain and D. E. Koehler May 1978 62 p
(PB-286076/5; BERC/OP-77/57; DOT-TSC-NHTSA-78-16; DOT-HS-803332) Avail: NTIS HC A04/MF A01 CSCL 21G

Experimental data were obtained in dynamometer tests of a 1977 Ford 2.3 liter (140 CID) engine to determine fuel consumption and emissions (hydrocarbon, carbon monoxide, oxides of nitrogen) at steady-state engine-operating modes. The engine performance data are used to estimate emissions and fuel economy for varied engine service and duty and provide basic engine characteristic data required as input for engineering calculations involving ground transportation. GRA

N79-15307# Department of Energy, Bartlesville, Okla. Energy Research Center.
PERFORMANCE CHARACTERISTICS OF AUTOMOTIVE ENGINES IN THE UNITED STATES THIRD SERIES: REPORT NO. 1 1977 VOLVO 130 CID (2.1 LITERS), F.I. Interim Report, Nov. 1977
D. E. Koehler, K. R. Stamper, and W. F. Marshall May 1978 46 p
(PB-286077/3; BERC/OP-77/60; DOT-TSC-NHTSA-78-19; DOT-HS-803335) Avail: NTIS HC A03/MF A01 CSCL 21G

Dynamometer tests of a 1977 Volvo 130 CID engine were conducted to determine fuel consumption and emissions (hydrocarbon, carbon monoxide, oxides of nitrogen) at steady-state engine-operating modes. Engine performance data are used to estimate emissions and fuel economy for varied engine service and duty and provide basic engine characteristic data required as input for engineering calculations involving ground transportation. GRA

N79-15308# Department of Energy, Bartlesville, Okla. Energy Research Center.
PERFORMANCE CHARACTERISTICS OF AUTOMOTIVE ENGINES IN THE UNITED STATES. SECOND SERIES, REPORT NO. 4: 1976 CHEVROLET 85 CID (1.4 LITERS), IV Interim Report, Nov. 1977
D. E. Koehler, T. W. Chamberlain, K. R. Stamper, and W. F. Marshall May 1978 54 p
(Contract DOT/TSC-RA-76-23)
(PB-286294/4; BERC/OP-77/58; DOT-TSC-NHTSA-78-15; DOT-HS-803331) Avail: NTIS HC A04/MF A01 CSCL 21G

Experimental data were obtained in dynamometer tests of a 1976 Chevrolet 85 CID engine to determine fuel consumption and emissions (hydrocarbon, carbon monoxide, oxides of nitrogen) at steady-state engine-operating modes. Engine performance data were obtained for estimating emissions and fuel economy for varied engine service and duty. Basic engine characteristic data required as input for engineering calculations involving ground transportation are provided. GRA

N79-15309# Department of Energy, Bartlesville, Okla. Energy Research Center.
PERFORMANCE CHARACTERISTICS OF AUTOMOTIVE ENGINES IN THE UNITED STATES. SECOND SERIES, REPORT NO. 6: 1976 NISSAN DIESEL 198 CID (3.2 LITERS), F. I. Interim Report, Nov. 1977
D. E. Koehler, K. R. Stamper, and W. F. Marshall May 1978 36 p
(Contract DOT/TSC-RA-76-23)
(PB-286295/1; BERC/OP-77/61; DOT-TSC-NHTSA-78-17; DOT-HS-803333) Avail: NTIS HC A03/MF A01 CSCL 21G

Experimental data were obtained in dynamometer tests of a

1976 Nissan diesel engine, Model SD-33 CN6-33, to determine fuel consumption and emissions (hydrocarbon, carbon monoxide, oxides of nitrogen) at steady-state engine-operating modes. Engine performance data were obtained for estimating emissions and fuel economy for varied engine service and duty. Basic engine characteristic data required as input for engineering calculations involving ground transportation are provided. GRA

N79-15310# Department of Energy, Bartlesville, Okla. Energy Research Center.
PERFORMANCE CHARACTERISTICS OF AUTOMOTIVE ENGINES IN THE UNITED STATES. SECOND SERIES, REPORT NO. 7: 1977 FORD 171 CID (2.8 LITERS), 2V Interim Report, Nov. 1977
D. E. Koehler, K. R. Stamper, and W. F. Marshall May 1978 64 p
(Contract DOT/TSC-RA-76-23)
(PB-286296/9; BERC/OP-77/62; DOT-TSC-NHTSA-78-18; DOT-HS-803334) Avail: NTIS HC A04/MF A01 CSCL 21G

Experimental data were obtained in dynamometer tests of a 1977 Ford 171 CID engine to determine fuel consumption and emissions (hydrocarbon, carbon monoxide, oxides of nitrogen) at steady-state engine-operating modes. Engine performance data were obtained for estimating emissions and fuel economy for varied engine service and duty. Basic engine characteristic data required as input for engineering calculations involving ground transportation are provided. GRA

N79-15311# Department of Energy, Bartlesville, Okla.
PERFORMANCE CHARACTERISTICS OF AUTOMOTIVE ENGINES IN THE UNITED STATES. FIRST SERIES, REPORT NO. 16: 1975 121 CID (2.0 LITERS), F.I. Interim Report, Aug. 1977
T. W. Chamberlain, D. E. Koehler, K. R. Stamper, and W. F. Marshall Aug. 1977 34 p
(Contract DOT/TSC-RA-75-10)
(PB-286297/7; BERC/OP-77/41; DOT-HS-803326) Avail: NTIS HC A03/MF A01 CSCL 21G

Experimental data were obtained in dynamometer tests of a 1975 Volvo, 2.0 liter (121 CID) engine to determine fuel consumption and emissions (hydrocarbon, carbon monoxide, oxides of nitrogen) at steady-state engine-operating modes. The objective of the program is to obtain engine performance data for estimating emissions and fuel economy for varied engine service and duty. The intent of the work is to provide basic engine characteristic data required as input for engineering calculations involving ground transportation. GRA

N79-15312# Department of Energy, Bartlesville, Okla. Energy Research Center.
PERFORMANCE CHARACTERISTICS OF AUTOMOTIVE ENGINES IN THE UNITED STATES. FIRST SERIES, REPORT NO. 17: 1975 BUICK 455 CID (7.5 LITERS), 4V Interim Report, Aug. 1977
T. W. Chamberlain, D. E. Koehler, K. R. Stamper, and W. F. Marshall May 1978 54 p
(Contract DOT/TSC-RA-75-10)
(PB-286298/5; BERC/OP-77/44; DOT-TSC-NHTSA-78-11; DOT-HS-803327) Avail: NTIS HC A04/MF A01 CSCL 21G

Experimental data were obtained in dynamometer tests of a 1975 Buick 455 CID, 4V engine to determine fuel consumption and emissions (hydrocarbon, carbon monoxide, oxides of nitrogen) at steady-state engine-operating modes. Engine performance data were obtained for estimating emissions and fuel economy for varied engine service and duty. Basic engine characteristic data required as input for engineering calculations involving ground transportation are provided. GRA

N79-15313# Department of Energy, Bartlesville, Okla. Bartlesville Energy Research Center.
PERFORMANCE CHARACTERISTICS OF AUTOMOTIVE ENGINES IN THE UNITED STATES. FIRST SERIES, REPORT NO. 18: 1976 FORD CID (6.6 LITERS), 2V Interim Report, Aug. 1977
W. F. Marshall and K. R. Stamper May 1978 56 p
(Contract DOT/TSC-RA-75-10)
(PB-286299/3; BERC/OP-77/52; DOT-TSC-NHTSA-78-12; DOT-HS-803328) Avail: NTIS HC A04/MF A01 CSCL 21G

Experimental data were obtained in dynamometer tests of a 1976 Ford 400 CID, 2V engine to determine fuel consumption and emissions (hydrocarbon, carbon monoxide oxides of nitrogen) at steady-state engine-operating modes. Engine performance data are used to estimate service and duty and provide basic engine characteristic data required as input for engineering calculations involving ground transportation. GRA

N79-15314# Department of Energy, Bartlesville, Okla.
PERFORMANCE CHARACTERISTICS OF AUTOMOTIVE ENGINES IN THE UNITED STATES. FIRST SERIES, REPORT NO. 19: 1975 FORD WINDSOR 351 CID (5.7 LITERS), 2V Interim Report, Aug. 1977
W. F. Marshall and K. R. Stamper May 1978 40 p
(Contract DOT/TSC-RA-75-10)
(PB-286300/9; BERC/OP-77/53; DOT-TSC-NHTSA-78-13; DOT-HS-803329) Avail: NTIS HC A03/MF A01 CSCL 21G

Experimental data were obtained in dynamometer tests of a Windsor engine to determine fuel consumption and emissions (hydrocarbon, carbon monoxide, oxides of nitrogen) at steady-state engine operating modes. The objective of the program is to obtain engine performance data for estimating emissions and fuel economy for varied engine service and duty. The intent of the work is to provide basic engine characteristic data required as input for engineering calculations involving ground transportation. GRA

N79-15315# Department of Energy, Bartlesville, Okla. Energy Research Center.
PERFORMANCE CHARACTERISTICS OF AUTOMOTIVE ENGINES IN THE UNITED STATES. FIRST SERIES, REPORT NO. 20: 1975 CHEVROLET 350 CID (5.7 LITERS) WITH DRESSER VARIABLE-AREA VENTURI SYSTEM Interim Report, Nov. 1977
T. W. Chamberlain, D. E. Koehler, K. R. Stamper, and W. F. Marshall May 1978 42 p
(Contract DOT/TSC-RA-75-10)
(PB-286301/7; BERC/OP-77/56; DOT-TSC-NHTSA-78-14; DOT-HS-803330) Avail: NTIS A03/MF A01 CSCL 21G

Experimental data were obtained in dynamometer tests of a 1975 Chevrolet 350 CID engine to determine fuel consumption and emissions (hydrocarbon, carbon monoxide, oxides of nitrogen) at steady-state engine-operating modes. Engine performance data were obtained for estimating emissions and fuel economy for varied engine service and duty. Basic engine characteristic data required as input for engineering calculations involving ground transportation are provided. GRA

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N79-15316# California Univ., Berkeley. Dept. of Industrial Engineering and Operations Research.
ON THE FIRST TIME A SEPARATELY MAINTAINED PARALLEL SYSTEM HAS BEEN DOWN FOR A FIXED TIME
Sheldon M. Ross and Jack Schechtman (Inst. of Pure and Appl. Math., Rio de Janeiro) Apr. 1978 16 p refs
(Contract N00014-77-C-0299; Grant AF-AFOSR-3213-77)
(AD-A059140; ORC-78-5) Avail: NTIS HC A02/MF A01 CSCL 14/4

A system is considered that consist of n separately maintained independent components where the components alternate between intervals in which they are up and in which they are down. When the ith component goes up (down) then, independent of the past, it remains up (down) for a random length of time having distribution F sub i (G sub i) and then goes down (up). Component i is failed at time t if it has been down at all time points s epsilon (t - A,t)otherwise it is said to be working. Thus a component is failed if it is down and has been down for the previous A time units. Assuming that all components initially start up let T denote the first time they are all failed, at which

point the system is failed. The moment generating function of T is obtained when n = 1, for general F and G, thus generalizing results which assumed that at least one of these distributions be exponential. Assumed that all the up and down distributions F sub i, G sub i, i = 1,...,n are exponential an exact expression for E(T) for general n is obtained. DOE

N79-15317# California Univ., Berkeley. Operations Research Center.
RELIABILITY GROWTH AS AN ARTIFACT OF RENEWAL TESTING
William S. Jewell Jun. 1978 23 p refs
(Grant AF-AFOSR-3179-77)
(AD-A059860; ORC-78-9) Avail: NTIS HC A02/MF A01 CSCL 14/4

It is shown that observed 'reliability growth' may be an artifact of limited-horizon renewal testing. The 'growth' of several estimators of failure rate and MTBF with test time is examined for a stationary renewal process. Author

N79-15318# RCA Government and Commercial Systems, Burlington, Mass. Automated Systems Div.
MANUFACTURING METHODS AND TECHNOLOGY PROGRAM AUTOMATIC IN PROCESS MICROCIRCUIT EVALUATION Quarterly Progress Report, 1 Apr. 1978 - 30 Jun. 1978
R. J. Wildenberger and L. Arlan Sep. 1978 68 p
(Contract DAAB07-77-C-0585)
(AD-A060896; DELET-TR-77-0585-3; QPR-3) Avail: NTIS HC A04/MF A01 CSCL 09/5

This report presents a technical and physical description of the Development Model equipment design and configuration. The work accomplished during the quarter and the task schedule are also presented. Plans for the next quarter have been developed and are outlined herein. Author (GRA)

N79-15319# Missouri Univ. - Columbia. Dept. of Statistics.
RELIABILITY OF MULTIPLE COMPONENT SYSTEMS
L. Lee and W. A. Thompson, Jr. 1977 11 p refs Presented at the 7th Prague Conf. on Inform. Theory, Statist. Decision Functions, Random Processes and of the 1974 European Meeting of Statisticians, held at Prague, 18-23 Aug. 1974
(Contracts N00014-75-C-0443; N00014-67-A-0287-004)
(AD-A059042) Avail: NTIS HC A02/MF A01 CSCL 14/4

A mathematical model is discussed which can be applied in biology (theory of competing risks) or in engineering to represent a nonrepairable series system. The components of the system are assumed to be independent. Dependence is then introduced in terms of sets of minima of independent random variables. The resulting multivariate distribution of component lifetimes generalizes Marshall and Olkin's multivariate exponential distribution but allows for the possibility of monotone failure rates. For example, the components may have a multivariate Weibull distribution. Author

N79-15320# Florida State Univ., Tallahassee. Dept. of Statistics.
NONPARAMETRIC METHODS WITH APPLICATIONS TO RELIABILITY Final Report, 1 Oct. 1976 - 30 Sep. 1978
Myles Hollander Sep. 1978 23 p refs
(Grant AF-AFOSR-3109-76; AF Proj. 2304)
(AD-A060371; AFOSR-78-1413TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

During the period (October 1, 1976 through September 30, 1978) under review, the principle investigator was mainly interested in the development of various methods in nonparametric and Bayesian inference with applications that are particularly relevant to reliability studies. Twelve technical reports were produced under this grant, and six articles were published in technical journals. Author (GRA)

N79-15321# Missouri Univ. - Columbia. Dept. of Statistics.
USE OF COVARIATES TO EXPLAIN (OR PREDICT) LIFE LENGTH Interim Technical Report
W. A. Thompson, Jr. 1 Jul. 1978 8 p ref
(Contract N00014-75-C-0443)
(AD-A060398; TR-75; Rept-78-1) Avail: NTIS HC A02/MF A01 CSCL 21/5

In medical, biological and engineering research, test results often appear in the form of a life table and it is desired to explain or predict life length in terms of, or perhaps allowing for, certain explanatory variables. Thus we may wish to explain human longevity in terms of geographical location or time of remission of leukemia patients in terms of drugs administered. The Navy has a problem involving the successive breakdowns of gas turbines. When breakdown occurs the turbines are not simply repaired but they are overhauled incorporating improved design features. They are looking for reliability growth from the first to the second, to the third, etc. installation. How can data of this kind be analyzed? Author (GRA)

N79-15322# Kentucky Univ., Lexington. Dept. of Statistics.
COMPREHENSIVE RESEARCH ON THE RELIABILITY AND PERFORMANCE OF SYSTEMS AND COMPONENTS ASSUMING MORE THAN TWO STATES Interim Report, 1 Jun. 1977 - 31 May 1978
Emad El-Neweihi May 1978 9 p refs
(Grant AF-AFOSR-3322-77)
(AD-A060415; AFOSR-78-1411TR) Avail: NTIS HC A02/MF A01 CSCL 14/4

The vast majority of reliability analyses assume that components and systems are in either of two states; functioning or failed. This represents an oversimplification of the many real life situations in which both components and systems assume a variety of states ranging from perfect functioning to complete failure. In the present work a basic theory was developed for the study of systems of components in which any of a finite number of states may occur, representing at one extreme perfect functioning and at the other extreme complete failure. The standard notion of Coherent Systems was extended to the new notion of a multistate coherent system. GRA

N79-15323# Rockwell International Corp., Thousand Oaks, Calif. Science Center.
PROCEEDINGS OF THE ARPA/AFML REVIEW OF PROGRESS IN QUANTITATIVE NONDESTRUCTIVE EVALUATION Annual Report, 4 Sep. 1976 - 30 Jun. 1977
Donald O. Thompson May 1978 393 p
(Contract F33615-74-C-5180; AF Proj. 7351)
(AD-A060783; SC595.24AR; AFML-TR-78-55; AR-3) Avail: NTIS HC A17/MF A01 CSCL 13/8

The edited transcripts of the ARPA/AFML Review of Quantitative NDE held on June 14-17, 1977, at Cornell University, Ithaca, New York, are presented in this document. Several key topics form the core of these presentations and discussions. They include quantitative ultrasonics, adhesives and composites, emissions related to failure prediction, residual stress, and reliability of ceramics. It is believed that this document provides a reasonable summary of NDE research and development currently underway. Author (GRA)

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N79-15324*# Texas A&M Research Foundation, College Station. Dept. of Aerospace Engineering.
DEVELOPMENT OF A MODERATELY SIZED FINITE ELEMENT PROGRAM FOR NONLINEAR STRUCTURAL ANALYSIS Final Report
Walter E. Haisler Jun. 1977 182 p refs
(Contracts NAS8-31332; N00014-76-C-0150)
(NASA-CR-150882; TR-3207-77-1) Avail: NTIS HC A09/MF A01 CSCL 20K

AGGIE 1 is a computer program for predicting the linear and nonlinear, static and dynamic structural response of two- and three-dimensional continuum solids. The program is based on isoparametric finite elements and allows for 2-D plane stress, plane strain, and axisymmetric analyses and general 3-D analyses. Large strain kinematics is based on the total Lagrangian

formulation. Materially nonlinear models include several elastic-plastic work-hardening models as well as an incompressible Mooney-Rivlin model. Included in this report is a brief description of the theoretical bases of the program, the material models used, the element library and the overall program organization. Instructions for data input preparation are given in detail. Several sample problems are given along with the required program input and program generated solutions. Author

N79-15325*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

CELFE/NASTRAN CODE FOR THE ANALYSIS OF STRUCTURES SUBJECTED TO HIGH VELOCITY IMPACT

C. C. Chamis 1978 25 p refs Presented at 7th NASTRAN User's Colloq., Huntsville, Ala., 4-6 Oct. 1978

(NASA-TM-79048; E-9857) Avail: NTIS HC A02/MF A01 CSCL 20K

CELFE (Coupled Eulerian Lagrangian Finite Element)/NASTRAN Code three-dimensional finite element code has the capability for analyzing of structures subjected to high velocity impact. The local response is predicted by CELFE and, for large problems, the far-field impact response is predicted by NASTRAN. The coupling of the CELFE code with NASTRAN (CELFE/NASTRAN code) and the application of the code to selected three-dimensional high velocity impact problems are described. Author

N79-15326*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

CODSTRAN: COMPOSITE DURABILITY STRUCTURAL ANALYSIS

C. C. Chamis and G. T. Smith 17 Nov. 1978 14 p refs Presented at the 4th Conf. on Fibrous Composites in Struct. Design, San Diego, Calif., 14-17 Nov. 1978

(NASA-TM-79070; E-9887) Avail: NTIS HC A02/MF A01 CSCL 20K

CODSTRAN (COmposite Durability STRuctural ANalysis) is an integrated computer program being developed for the prediction of defect growth and fracture of composite structures subjected to service loads and environments. CODSTRAN is briefly described with respect to organization, capabilities and present status. Application of CODSTRAN current capability to a flat composite laminate with a center slit which was subjected to axial tension loading predicted defect growth which is in good agreement with C-scan ultrasonic test records. Author

N79-15327*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

A REVIEW AND ASSESSMENT OF THE STRESS-INTENSITY FACTORS FOR SURFACE CRACKS

J. C. Newman, Jr. Nov. 1978 51 p refs Presented at ASTM Symp. on Part-Through Crack Life Prediction, San Diego, Calif., 13-14 Oct. 1977

(NASA-TM-78805) Avail: NTIS HC A04/MF A01 CSCL 20K

The stress-intensity factor solutions proposed for a surface crack in a finite plate subjected to uniform tension are reviewed. Fourteen different solutions for the stress-intensity factors are compared. These solutions were obtained over the past 16 years using approximate analytical methods, experimental methods, and engineering estimates. The accuracy is assessed of the various solutions by correlating fracture data on surface-cracked tension specimens made of a brittle epoxy material. Fracture of the epoxy material was characterized by a constant value of stress-intensity factor at failure. Thus, the correctness of the various solutions is judged by the variations in the stress-intensity factors at failure. The solutions were ranked in order of minimum standard deviation. The highest ranking solutions correlated 95 percent of data analyzed within + or - 10 percent, whereas the lowest ranking solutions correlated 95 percent of data analyzed within + or - 20 percent. However, some solutions could be applied to all data considered, whereas others are limited with respect to crack shapes and crack sizes that could be analyzed. F.O.S.

N79-15328# Air Force Materials Lab., Wright-Patterson AFB, Ohio.

AN INTEGRAL-EQUATION SOLUTION FOR A BOUNDED ELASTIC BODY WITH AN EDGE CRACK: MODE 1 DEFORMATIONS Final Report, Sep. 1977 - May 1978

Thomas J. Rudolphi Jul. 1978 38 p refs

(AF Proj. 2307)

(AD-A060846; AFML-TR-78-113) Avail: NTIS HC A03/MF A01 CSCL 20/11

The quadrature form solution for a pressurized semi-infinite crack in an infinite lammina and the boundary-integral equation solution of an unflawed medium are combined to solve the problem of an edge crack in a bounded, two-dimensional medium under mode 1 conditions. The formulation allows for the direct evaluation of the stress intensity factor. Algorithms for the numerical solution of the integral equations are developed and applied to several illustrative problems. Results obtained agree well with exact and other numerical solutions. Author (GRA)

N79-15329# Illinois Inst. of Tech., Chicago.

UNIFIED CONSTITUTIVE EQUATIONS FOR ELASTIC AND PLASTIC BEHAVIOR

Barry Berstein 1977 8 p Repr. from the 14th Ann. Meeting of the Soc. of Eng. Sci., Lehigh Univ., Bethlehem, Penn., 14-16 Nov. 1977

(Grant DAAG29-77-G-0082)

(AD-A057572) Avail: NTIS HC A02/MF A01 CSCL 11/9

A set of constitutive equations is presented which gives rise both to elastic and plastic behavior in loading and unloading. Elastic behavior corresponds to uniqueness of solutions of differential equations and occurs when a Lipschitz condition holds. Failure of the Lipschitz condition corresponds to a von-Mises yield condition, which gives rise to plastic yield and the Prandtl-Reuss equations during loading. During unloading the stable solution dictates reentry into an elastic regime. Linear behavior can be approximated arbitrarily closely in elastic regimes. An extension to strain hardening is illustrated. Author

N79-15330# Lehigh Univ., Bethlehem, Pa. Center for the Application of Mathematics.

THE INCREMENTAL SHEAR MODULUS IN AN INCOMPRESSIBLE ELASTIC MATERIAL

K. N. Sawyers and R. S. Rivlin Sep. 1978 20 p refs

(Contract N00014-76-C-0235)

(AD-A060453; CAM-100-32) Avail: NTIS HC A02/MF A01 CSCL 20/11

The incremental shear modulus is calculated for infinitesimal shear of an incompressible isotropic elastic material in a state of pure homogeneous deformation. Necessary and sufficient conditions that it be positive are obtained. These conditions are related to the Hadamard conditions for propagation of a wave of infinitesimal amplitude in the deformed material.

Author (GRA)

N79-15331# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Geotechnical Lab.

IN SITU AND LABORATORY DETERMINATIONS OF SHEAR AND YOUNG'S MODULI FOR THE PORTSMOUTH, OHIO, GASEOUS DIFFUSION ADD-ON SITE Final Report

Joseph R. Curro, Jr. and William F. Marcuson, III Aug. 1978 166 p refs

(AD-A059988; WES-MP-S-78-12) Avail: NTIS HC A08/MF A01 CSCL 13/13

A field geophysical investigation was performed to determine the Shear and Young's moduli as a function of depth for a site near Portsmouth, Ohio. This investigation included crosshole, downhole, and surface refraction investigation techniques. A supplementary set of laboratory resonant column tests was performed with the Drnevich resonant column device. Laboratory undisturbed specimens were excited in both the longitudinal and torsional modes to obtain both Young's and Shear moduli as a function of strain. Both laboratory and field data are presented and compared. The internal damping of the soil deposit was found to range from 3 to 5 percent for low dynamic strain amplitudes and is constant with depth. The bedrock has a Shear modulus of 125,000 psi and a Young's modulus of 370,000 psi. Author

N79-15332# Air Force Academy, Colo. Frank J. Seiler Research Lab.

HIGHER ORDER GASDYNAMIC THEORY OF SHOCK STRUCTURE Technical Report, Jan. 1973 - Aug. 1977

Charles E. Simon Dec. 1977 150 p refs
(AF Proj. 2307)
(AD-A060627; FJSRL-TR-77-0015) Avail: NTIS HC A07/MF A01 CSCL 20/4

This document is the final report concerning the theoretical investigation of the structure of a normal shock wave in a gas composed of Maxwell molecules. The higher order gasdynamic differential equations for the shock structure are derived from this Boltzmann equation through fourth order in spatial derivatives (Super-Super-Burnett Order). The derivation employs a simplified version of the well known Chapman-Enskog development. Perturbation methods are used to find approximate solutions for the Super Burnett (third order) and Super-Super-Burnett (fourth order) equations which are not amenable to numerical integration by conventional techniques. The perturbation methods are shown to produce satisfactory approximate solutions for the Navier-Stokes and Burnett equations which are amenable to numerical integration. The higher order gasdynamic corrections to the Navier-Stokes shock structure for a Maxwell gas are shown to be qualitatively similar to the discrepancies between experimental results and the Navier-Stokes shock structure for a realistic intermolecular potential. Author (GRA)

N79-15333# Lockheed Missiles and Space Co., Palo Alto, Calif. Applied Mechanics Lab.

DIRECT TIME INTEGRATION METHODS IN NONLINEAR STRUCTURAL DYNAMICS

C. A. Felippa and K. C. Park Aug. 1978 74 p refs Presented at the Intern. Conf. on Finite Elements in Nonlinear Mech. (FENMECH 78) Stuttgart, 1 Sep. 1978
(Contract N00014-74-C-0355)
(AD-A060410; LMSC/D013361) Avail: NTIS HC A04/MF A01 CSCL 12/1

This paper reviews some recent developments in direct time integration methods for nonlinear structural dynamics. The developments pertain to the use of linear multistep difference operators in conjunction with the pseudo-force approach. The paper is organized into three main sections. An introductory section provides an overview of the transient response analysis problem. A section on computational aspects deals with the organization of the numerical calculations; this material is largely based on a recent detailed study of linear dynamic calculations. A section on integration methods highlights algorithmic aspects that impact the selection of integrator for nonlinear problems and discusses adaptive analysis features such as stepsize control and implicit matrix scaling techniques. An appendix section outlines the functional organization of modular 'integration driving' software. Author (GRA)

N79-15334# Army Materials and Mechanics Research Center, Watertown, Mass.

LASER-PRODUCED STRENGTH DEGRADATION OF PLATES IN TENSION AND TUBES IN TORSION Final Report

Jiro Adachi, Robert F. Anastasi, and John F. Beatty Apr. 1978 32 p refs
(DA Proj. 1T1-62105-AH-84)
(AD-A060454; AMMRC-TR-78-17) Avail: NTIS HC A03/MF A01 CSCL 20/11

Preliminary observations and conclusions regarding laser damage of tension plates and rotating torsion tubes of 7075-T6 aluminum alloy are presented. Good correlations between laser irradiance and physical damage measurements were observed. Load during laser damage has a beneficial effect on fracture strength of tension plates. Torsion tubes are highly susceptible to yielding crippling failure under combined load and narrow laser beam irradiation. Fracture mechanics procedures provide consistent results although scatter of damage and failure results indicate the advisability of using statistical rather than deterministic procedures. Author (GRA)

N79-15335# Naval Research Lab., Washington, D. C.

FRACTOGRAPHIC ANALYSIS OF FATIGUE SPECIMENS OF ANNEALED TYPE 304 STAINLESS STEEL Final Report

V. Provenzano and F. A. Smidt, Jr. 21 Sep. 1978 35 p refs
(AD-A060547; NRL-8258) Avail: NTIS HC A03/MF A01 CSCL 11/6

The fracture surfaces of fatigue specimens of Type 304 stainless steel previously tested at elevated temperatures in air were examined by scanning electron microscopy (SEM) to characterize the failure processes and establish correlations with previous studies performed at NRL of fatigue crack propagation in Type 316 stainless steel. The SEM observations showed significantly different types of fatigue behavior which could be explained in terms of differences in material processing history and test conditions. Solution-annealed (SA) material tested at 427 C (800 F) exhibited a transgranular failure mode with fatigue striations indicative of a ductile failure process. Solution-annealed material tested at 593 C (1100 F) showed a change in failure mode to partially intergranular failure and an increase in the crack growth rate relative to tests at 427 C. Imposition of a hold time up to 1 min further increased the proportion of the fracture surface characterized by intergranular failure, and the crack growth rate also increased. The material that had been aged at 593 C and tested at 427 C and at 593 C showed a return to transgranular failure. The crack growth rate in the aged material tested at 427 C was comparable to that of the SA material tested at the same temperature, while the growth rate of the aged material at 593 C was somewhat higher than at 427 C. Observations were consistent with a model in which the grain boundaries were embrittled by diffusion of oxygen ahead of the crack tip, resulting in intergranular failure and an increased crack growth rate. GRA

N79-15336# California Univ., Berkeley. Dept. of Mechanical Engineering.

ON THERMAL EFFECTS IN THE THEORY OF SHELLS

A. E. Green and P. M. Naghdi Sep. 1978 54 p refs
(Contract N00014-75-C-0148)
(AD-A060800; UCB/AM-78-4) Avail: NTIS HC A04/MF A01 CSCL 20/11

This paper is concerned with thermomechanics of thin shells by a direct approach based on the theory of a Cosserat Surface comprising a two-dimensional surface and a single director attached to every point of the surface. In almost all previous developments of the thermo-mechanical theory of shells by direct approach, only one temperature field has been admitted. This allows for the characterization of temperature changes along some reference surface, such as the middle surface, of the (three-dimensional) shell-like body, but not for temperature changes along the shell thickness. A main purpose of the present study is to incorporate the latter effect into the theory; and, in the context of the theory of a Cosserat surface, this is achieved by a recent approach to thermomechanics (Green and Naghdi 1977) which provides a natural way of introducing two (or more) temperature fields at each material point of the surface. Attention is given to a discussion of symmetries (including material symmetries) and thermal effects in the nonlinear theory of elastic shells with detailed discussion of the linear theory of elastic plates. GRA

N79-15337# Michigan Univ., Ann Arbor. Dept. of Civil Engineering.

DELAYING SHEAR STRENGTH DECAY IN REINFORCED CONCRETE FLEXURAL MEMBERS UNDER LARGE LOAD REVERSALS

C. F. Scribner and J. K. Wight May 1978 245 p refs
(Grant NSF ENV-75-13900)
(PB-286570/7; UMEE-78R2) Avail: NTIS HC A11/MF A01 CSCL 13M

Eight half-size and four full-size T-shaped reinforced concrete exterior beam-column subassemblies were tested to determine the effect of intermediate longitudinal shear reinforcement on the hysteretic behavior of flexual members subjected to repeated reversed loading. Specimens were tested by applying a constant axial load to the fixed column portion of the specimen and applying a cyclic shear load to the beam. The beam typical loading history was chosen to simulate the distortion which might take place at a typical connection in a ductile moment-resisting frame during a severe earthquake. Several conclusions were drawn on the basis of test results. GRA

N79-15338# Massachusetts Inst. of Tech., Cambridge. Marine Industry Advisory Services.

VIBRATION RESPONSE AND THE STRUCTURAL INTEGRITY OF DEEPWATER STRUCTURES

Norman Doelling 1 Jul. 1978 25 p refs
(PB-286846/1; Mitsg-78-10; Opportunity Brief-10; NOAA-78082101) Avail: NTIS HC A02/MF A01 CSCL 13J

Vibration analysis services appear to have an important role in monitoring the structural behavior of offshore platforms. Appropriate measurement techniques and data analysis need to be coupled closely with studies of the dynamics of the system in order to interpret the significance of the data. The studies indicate several important points: (1) design for vibration control can obviate serious resonance problems; (2) liquid damping techniques hold great promise as vibration control tools if properly applied; and (3) the effects of vibration and attendant cyclic stress on soil foundations are extremely important. GRA

N79-15339# Battelle Columbus Labs., Ohio.
CRITICAL EXPERIMENTS, MEASUREMENTS, AND ANALYSIS TO ESTABLISH A CRACK ARREST METHODOLOGY FOR NUCLEAR PRESSURE VESSEL STEELS
G. T. Hahn Apr. 1978 63 p refs
(Contract AT(49-24)-0293)
(PB-283032/1; NUREG-CR-0080; QR-11) Avail: NTIS HC A04/MF A01 CSCL 11F

The governing equations for crack propagation and arrest in a cylinder under thermal and/or pressure stresses are derived and preliminary numerical tests of a computer algorithm that will eventually simulate the ORNL thermal shock experiments are presented. The basic computational procedure is found to be acceptable but a particular need for accurate propagating-crack fracture toughness K sub m input data is dientified. To this end the test procedure has been successfully modified by the adoption of transverse wedge loading which substantially eliminates the errors due to extraneous load-point displacement. GRA

N79-15340# United States Steel Corp., Monroeville, Pa.
FATIGUE OF WELDED STEEL BRIDGE MEMBERS UNDER VARIABLE-AMPLITUDE LOADINGS Final Report
C. G. Schilling, K. H. Klippstein, J. M. Barsom, and G. T. Blake Transportation Res. board Washington, D. C. Jun. 1978 123 p refs Sponsored by Federal Highway Admin., and Am. Assoc. of State Highway and Transportation Officials
(PB-285975/9; TRB/NCARP/REP-188; ISBN-0-309-02776-4) Avail: NTIS MF A01; HC $6.40 from Transportation Research Board, 2101 Constitution Ave., NW, Washington, D. C. CSCL 13B

The findings from an extensive laboratory investigation of fatigue effects in welded steel beams subjected to variable-amplitude loadings similar to those that occur in actual bridges are presented. Fatigue data on welded bridge members under variable-amplitude random-sequence stress spectrums such as occur in actual bridges are included along with an analytical method of predicting variable-amplitude fatigue behavior from constant-amplitude fatigue data. Results of an experimental program that included constant- and variable-amplitude fatigue tests of both small specimens and relatively large beams of various steels are given. New fatigue provisions are suggested for incorporation into the AASHTO Standard Specifications for Highway Bridges. GRA

N79-15341# University of Southern Calif., Los Angeles. Dept. of Civil Engineering.
DYNAMIC EXCITATION OF A SINGLE-DEGREE-OF-FREEDOM HYSTERETIC SYSTEM Topical Report, 1 Oct. 1977 - 30 Sep. 1978
S. J. Stott and S. F. Masri Aug. 1978 114 p refs
(Contract NRC-04-76-262)
(PB-287480/8; NUREG-CR-0362; CE-78-09) Avail: NTIS HC A06/MF A01 CSCL 18E

An analytical investigation is made of the dynamic response of two special classes of nonlinear hysteretic oscillators that model some of the basic phenomena involved in the response of complex nuclear power plant systems which are subjected to dynamic environments. Numerical studies as well as approximate analytical solutions for the response of the nonlinear oscillators under (1) harmonic and (2) random excitation are presented. The effects of various system parameters are evaluated and the range of validity of the approximate solutions is determined. GRA

N79-15342# Nuclear Regulatory Commission, Washington, D.C. Div. of Operating Reactors.
METHODOLOGY FOR COMBINING DYNAMIC RESPONSES. NRC STAFF WORKING GROUP REPORT
R. Cudlin, S. Hosford, R. Mattu, and K. Wichman Sep. 1978 26 p refs
(PB-287432/9; NUREG-0484) Avail: NTIS HC A03/MF A01 CSCL 18E

Several approaches to account for the potential interaction of loads resulting from accidents and natural phenomena were used. One approach, the so-called absolute or linear summation (ABS) method, linearly adds the peak structural responses due to the individual dynamic loads. A second approach, referred to as SRSS, yields a combined response equal to the square root of the sum of the squares of the peak responses due to the individual dynamic loads. The lack of a physical relationship between some of the loads has raised questions as to the proper methodology to be used in the design of nuclear power plants. Evaluations of and recommendations on the use of the ABS and SRSS methods are provided in the report. GRA

N79-15343# Illinois Univ. at Urbana-Champaign, Urbana.
ELASTODYNAMIC ANALYSIS OF A PROPAGATING FINITE CRACK
K. S. Kim and H. T. Corten Jun. 1978 85 p refs Prepared for Battelle Columbus Labs., Ohio
(Contract AT(49-24)-0293; EPRI Proj. 303-2)
(PB-283182/4; NUREG-CR-0111) Avail: NTIS HC A05/MF A01 CSCL 20K

An analytical method is described for handling the dynamic, two-dimensional problem of a crack propagating in an infinite medium. The problem is formulated in terms of an integral equation involving the normal stress and crack surface rotation in the crack plane. Given any particular loading, the crack surface rotation may be determined by solving this integral equation numerically. The dynamic stress intensity factor is then obtained directly from crack surface rotation at the crack tip. The velocity of the crack tip is not restricted by the form of the integral equation, so it could be allowed to vary with time. The crack can be of either finite or semi-finite length. GRA

N79-15344# Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
DYNAMIC STIFFNESS OF FOUNDATIONS: 2-D VS. 3-D SOLUTIONS
Moshe Jakub and Jose M. Roesset Oct. 1977 49 p refs
(Grant NSF AEN-74-17835)
(PB-286504/6; MIT-CE-R77-36; RR-6) Avail: NTIS HC A03/MF A01 CSCL 13M

Approximate formulae for the dynamic stiffness of embedded strip footings are developed through parametric studies. A comparison is then established between the static value of these stiffnesses and their frequency variation for two- and three-dimensional solutions. A plane strain model is demonstrated to be incapable of reproducing all the stiffness terms of a circular or square foundation. As a preliminary method of analysis, construction of similar formulae and graphs provides estimates of the natural frequency and effective modal damping provided by two- and three-dimensional finite element solutions. The magnitude of error in adopting a plane strain model may then be evaluated. GRA

N79-15345# Terra Tek, Inc., Salt Lake City, Utah.
K MEASUREMENTS USING SHORT ROD SPECIMENS: THE ELASTIC-PLASTIC CASE
L. M. Barker Nov. 1977 33 p refs Sponsored in part by NSF
(PB-287088/9; TR-77-91R; NSF/RA-770521) Avail: NTIS HC A03/MF A01 CSCL 13C

A data reduction scheme is reported whereby a value for K(Ic), a material's plane strain critical stress intensity factor, can be determined even in those cases where the effect of the plastic zone size is far from negligible. An elastic-plastic analysis is presented which allows a material's plane strain critical intensity factor to be measured using short rod specimens. The practical application of the analysis is illustrated in an experimental determination of the K(Ic) of limestone, using short rod specimens of three different sizes. One K(Ic) value is obtained from

each specimen. The results appear to be independent of the specimen size. GRA

42 GEOSCIENCES (GENERAL)

No abstracts in this category.

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

N79-15346*# South Dakota State Univ., Brookings. Remote Sensing Inst.

HCMM ENERGY BUDGET DATA AS A MODEL INPUT FOR ASSESSING REGIONS OF HIGH POTENTIAL GROUND-WATER POLLUTION Interim Report, Jul. - Sep. 1978

Donald G. Moore, Principal Investigator, J. Heilman, and J. Tunheim Sep. 1978 9 p refs ERTS

(Contract NAS5-2406)

(E79-10002; NASA-CR-157897; QR-5) Avail: NTIS HC A02/MF A01 CSCL 13B

The author has identified the following significant results. Analysis of soil temperature and water table data indicated that shallow aquifers appear to produce a heat sink effect when the depth to water table is approximately four meters or less.

N79-15347*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.

DETECTION AND MAPPING PACKAGE. ANALYST'S GUIDE; INTERPRETING IMPOUNDED SURFACE WATER Final Report, Jan. - Apr. 1978

R. C. Carnes, Principal Investigator, E. H. Schlosser, and R. G. Davis Sep. 1978 74 p refs Revised Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 EREP

(Contract NAS9-15200)

(E79-10067; NASA-CR-151857; LEC-12149; JSC-13970) Avail: NTIS HC A04/MF A01 CSCL 08H

There are no author-identified significant results in this report.

N79-15348*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). REVIEW OF LACIE METHODOLOGY, A PROJECT EVALUATION OF TECHNICAL ACCEPTABILITY

Jul. 1978 27 p Sponsored by NASA, NOAA, and USDA EREP

(E79-10069; NASA-TM-79932; LACIE-00421; JSC-11327) Avail: NTIS HC A03/MF A01 CSCL 02C

The author has identified the following significant results. Results indicated that the LANDSAT data and the classification technology can estimate the small grains area within a sample segment accurately and reliably enough to meet the LACIE goals. Overall, the LACIE estimates in a 9 x 11 kilometer segment agree well with ground and aircraft determined area within these segments. The estimated c.v. of the random classification error was acceptably small. These analyses confirmed that bias introduced by various factors, such as LANDSAT spatial resolution, lack of spectral resolution, classifier bias, and repeatability, was not excessive in terms of the required performance criterion. Results of these tests did indicate a difficulty in differentiating wheat from other closely related small grains. However, satisfactory wheat area estimates were obtained through the reduction of the small grain area estimates in accordance with relative amounts of these crops as determined from historic data; these procedures are being further refined.

N79-15349*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). LEVEL 3 BASELINE; CLASSIFICATION AND MENSURATION SUBSYSTEM (CAMS) REQUIREMENTS, VOLUME 2, REVISION E

May 1978 121 p Revised Sponsored by NASA, NOAA, and USDA EREP

(E79-10070; NASA-TM-79933; LACIE-C00200-Vol-2-Rev-E; JSC-11330-Vol-2-Rev-E) Avail: NTIS HC A06/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N79-15350*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). YIELD-WEATHER REGRESSION MODELS FOR THE CANADIAN PRAIRIES

Sharon K. LeDuc, Principal Investigator Jun. 1977 28 p refs Revised Sponsored by NASA, NOAA, and USDA EREP

(E79-10071; NASA-TM-79934; LACIE-00433-Rev-A; JSC-11658-Rev-A) Avail: NTIS HC A03/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N79-15351*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.

NATIONWIDE FORESTRY APPLICATIONS PROGRAM. A LITERATURE REVIEW OF MAJOR REMOTE SENSING PROJECTS MAPPING FOREST LAND IN THE UNITED STATES, USING SATELLITE DATA AND AUTOMATIC DATA PROCESSING

E. P. F. Kan, Principal Investigator Oct. 1978 73 p EREP

(Contract NAS9-15200)

(E79-10072; NASA-CR-151858; LEC-12131; JSC-13978) Avail: NTIS HC A04/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N79-15352*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). LEVEL 3 BASELINE; SYSTEM PERFORMANCE EVALUATION, REPORT INTEGRATION (SPE-RI) REQUIREMENTS, VOLUME 6-B

16 Dec. 1974 48 p refs Sponsored by NASA, NOAA, and USDA EREP

(E79-10073; NASA-TM-79965; LACIE-00200-Vol-6-B) Avail: NTIS HC A03/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N79-15353*# Cornell Univ., Ithaca, N. Y.

CORNELL UNIVERSITY REMOTE SENSING PROGRAM Semiannual Status Report, 1 Jun. - 30 Nov. 1978

Ta Liang, Arthur J. McNair, and Warren R. Philipson, Principal Investigators Dec. 1978 119 p refs ERTS

(Grant NGL-33-010-171)

(E79-10074; NASA-CR-157967; SASR-13) Avail: NTIS HC A06/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N79-15354*# California Univ., Berkeley. Space Sciences Lab.

APPLICATION OF REMOTE SENSING TO SELECTED PROBLEMS WITHIN THE STATE OF CALIFORNIA Annual Report

Robert N. Colwell, Andrew S. Benson, John E. Estes, and Leonard W. Bowden, Principal Investigators 1 May 1978 193 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS

(Grant NsG-7220)

(E79-10075; NASA-CR-157968; SSL-Ser-19-Issue-64) Avail: NTIS HC A09/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N79-15355*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
ANALYSIS OF PRINCIPAL COMPONENT TRANSFORMED LANDSAT DATA
R. A. Abotteen, Principal Investigator Aug. 1976 25 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 EREP
(Contract NAS9-12200)
(E79-10076; NASA-CR-151861; LEC-9003) Avail: NTIS HC A02/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N79-15356*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
TEST AND EVALUATION OF PRINCIPAL COMPONENT CLUSTER IMAGES IN LACIE
R. A. Abotteen, Principal Investigator Mar. 1977 17 p refs EREP
(Contract NAS9-15200)
(E79-10077; NASA-CR-151860; LEC-10052) Avail: NTIS HC A02/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N79-15357*# Florida Univ., Gainesville. Florida Agricultural Market Research Center.
COMMERCIAL FISHING PORT DEVELOPMENT IN NORTH FLORIDA
Kary Mathis, Principal Investigator, James C. Cato, Paul D. Degner, Paul D. Landrum, and Fred J. Prochaska Sep. 1978 242 p refs Sponsored by NASA and in part by Gulf and South Atlantic Fisheries Development Foundation, Inc. Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(E79-10078; NASA-CR-157971; Rept-78-6) Avail: NTIS HC A11/MF A01 CSCL 05C

The author has identified the following significant results. Seven major counties were examined: Escambia, Bay, Gulf, Franklin, Wakulla, Nassau, and Duval. Population and economic activity were reviewed, along with commercial fishing and port facilities. Recommendations for five northwest Florida counties were based on interpretation of aerial photographs, satellite imagery, an aerial survey site visit, and published data. Major needs in Pensacola included docking, ice supply, and net and engine repair services. Costs for additional docks, an ice plant, and gear storage were estimated at $3,658,600. Port users in Panama City identified additional docking and gear storage as primary needs, along with gear repair and a marine railway. Estimated costs for dock and gear storage were $2,860,000. Added docking, gear storage, and ice supply, as well as gear electronics and diesel repair were needed in Port St. Joe. Costs were calculated at $1,231,500. Franklin County has three ports (Apalachicola - $1,107,000 for docks and gear storage, Eastpoint - $420,000 for additional docks, and Carrabella - $2,824,100 for docks, gear storage, and ice plant).

N79-15358*# Texas A&M Univ., College Station. Remote Sensing Center.
DRYLAND PASTURE AND CROP CONDITIONS AS SEEN BY HCMM Progress Report, Jul. - Oct. 1978
W. D. Rosenthal, Principal Investigator, J. C. Harlan, and Bruce J. Blanchard Oct. 1978 20 p ERTS
(Contract NAS5-24383)
(E79-10079; NASA-CR-157972; RSC-3712-3) Avail: NTIS HC A02/MF A01 CSCL 02C

The author has identified the following significant results. The soil moisture difference between the flight lines was partly due to water-holding capacity differences of the two soil types. Fields along the east flight line were in clay; while along the west flight line, the soil was sandy loam which holds less moisture. Due to differences in the amount of green material, the pastures were wetter than the wheat fields. Most of the pastures average from 40-80% green material, while wheat averages from 90-100% green material. A large amount of green material transpired more water and depleted the soil water content faster than dead vegetation. Visicorder data found temperature differences between the rangeland and winter wheat fields. Pasture had a larger percentage of dead material with different thermal properties than live vegetation, and surface temperature was primarily dependent on insolation. Dead material transpired less, but warms up faster than wheat fields.

N79-15359*# Agricultural Research Service, Weslaco, Tex.
PLANT COVER, SOIL TEMPERATURE, FREEZE, WATER STRESS, AND EVAPOTRANSPIRATION CONDITIONS Quarterly Progress Report, 1 Sep. - 1 Dec. 1978
Craig L Wiegand, Paul R Nixon, Harold W. Gausman, L. Neal Namken, Ross W. Leamer, and Arthur J. Richardson, Principal Investigators Dec. 1978 11 p refs ERTS
(NASA Order S-40198-B)
(E79-10080; NASA-CR-157973) Avail: NTIS HC A02/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N79-15360*# Geological Survey, Denver, Colo. Branch of Petrophysics and Remote Sensing.
GEOLOGIC APPLICATION OF THERMAL-INERTIA MAPPING FROM SATELLITE Progress Report, 1 Sep. - 31 Nov. 1978
Terry W. Offield, Principal Investigator, Susanne H. Miller, and Kenneth Watson Dec. 1978 9 p Sponsored by NASA ERTS
(E79-10081; NASA-CR-157974) Avail: NTIS HC A02/MF A01 CSCL 08B

The author has identified the following significant results. Approximately 400 miles of low altitude scanner data of good quality was acquired over the Powder River Basin between 13-16 Oct. 1978. Radiometric and meteorological data from three ground stations were also acquired in support of low altitude U.S.G.S. overflights.

N79-15361*# California Univ., Berkeley. Space Sciences Lab.
AN INTEGRATED STUDY OF EARTH RESOURCES IN THE STATE OF CALIFORNIA USING REMOTE SENSING TECHNIQUES Annual Progress Report
Robert N. Colwell, Ralph Algazi, Leonard W. Bowden, John E. Estes, Ida R. Hoos, and Siamak Khorram, Principal Investigators 1 May 1978 220 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(Grant NGL-05-003-404)
(E79-10082; NASA-CR-157975; SSL-Ser-19-Issue-53-Vol-1) Avail: NTIS HC A10/MF A01 CSCL 08F

There are no author-identified significant results in this report.

N79-15362*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
A DETERMINATION OF THE OPTIMUM TIME OF YEAR FOR REMOTELY CLASSIFYING MARSH VEGETATION FROM LANDSAT MULTISPECTRAL SCANNER DATA
M. Kristine Butera, Principal Investigator Oct. 1978 40 p refs Sponsored by NASA EREP
(E79-10084; NASA-TM-58212; Rept-169) Avail: NTIS HC A03/MF A01 CSCL 02F

The author has identified the following significant results. A technique was used to determine the optimum time for classifying marsh vegetation from computer-processed LANDSAT MSS data. The technique depended on the analysis of data derived from supervised pattern recognition by maximum likelihood theory. A dispersion index, created by the ratio of separability among the class spectral means to variability within the classes, defined the optimum classification time. Data compared from seven LANDSAT passes acquired over the same area of Louisiana marsh indicated that June and September were optimum marsh mapping times to collectively classify Baccharis halimifolia, Spartina patens, Spartina alterniflora, Juncus roemericanus, and Distichlis spicata. The same technique was used to determine the optimum classification time for individual species. April appeared to be the best month to map Juncus roemericanus; May, Spartina

alterniflora; June, Baccharis halimifolia; and September, Spartina patens and Distichlis spicata. This information is important, for instance, when a single species is recognized to indicate a particular environmental condition.

N79-15363*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
UTILIZATION OF ORBITAL DATA FROM LANDSAT 1 IN THE CLASSIFICATION OF URBAN LAND USAGE OF THE SAO JOSE GRASSLAND [UTILIZACAO DE DADOS ORBITAIS DO LANDSAT-1 NA CLASSIFICACAO DE USO DO SOLO URBANO DE SAO JOSE DOS CAMPOS]
Nelson deJesusParada, Principal Investigator and Madalena Niero Jul. 1978 81 p refs In PORTUGUESE; ENGLISH summary Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(E79-10085; NASA-CR-157977; INPE-1295-TPT/093) Avail: NTIS HC A05/MF A01 CSCL 08B

There are no author-identified significant results in this report.

N79-15364*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
LANDSAT AND ENVIRONMENTAL IMPACT IN THE PARAIBA VALLEY OF SAO PAULO [LANDSAT E IMPACTO AMBIENTAL NO VALE DO PARAIBA ESTADO DE SAO PAULO]
Nelson deJesusParada, Principal Investigator and Dall Arthur Cottrell 20 Apr. 1978 9 p refs In PORTUGUESE Sponsored by NASA ERTS
(E79-10086; NASA-CR-157978; INPE-1222-PE/124) Avail: NTIS HC A02/MF A01 CSCL 13B

There are no author-identified significant results in this report.

N79-15365*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
STUDY OF THE POSSIBLE USAGE OF INFRARED PHOTOGRAPHIC MAPPING TO EVALUATE CULTIVATED AREAS IN JARDINOPOLIS, SP [ESTUDO DA VIABILIDADE DO USO AMOSTRAL DE FOTOGRAFIAS AEREAS (INFRAVERMELHO COLORIDO) PARA ESTIMATIVA DE AREAS CULTIVADAS EN JARDINOPOLIS SP]
Nelson deJesusParada, Principal Investigator, Getulio Teixeira Batista, David Chung Liang Lee, Sherry Chou Chen, Antonio Tebaldi Tardin, Rene Antonio Novaes, and Luis Paulo Tosca Mar. 1977 36 p refs In PORTUGUESE Sponsored by NASA ERTS
(E79-10087; NASA-CR-157979; INPE-1006-NTE/077) Avail: NTIS HC A03/MF A01 CSCL 08B

There are no author-identified significant results in this report.

N79-15366*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
APPLICATION OF LANDSAT IN THE EVALUATION OF ARGICULTURAL AND FOREST RESOURCES [APLICACO DO SISTEMA LANDSAT NA AVALIACAO DE RECURSOS AGRONOMICOS E FLORESTAIS]
Nelson deJesusParada, Principal Investigator and Mario Valerio Filho Nov. 1977 10 p refs In PORTUGUESE Sponsored by NASA ERTS
(E79-10088; NASA-CR-157980; INPE-1153-PE/105) Avail: NTIS HC A02/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N79-15367*# South Dakota State Univ., Brookings. Remote Sensing Inst.
REMOTE SENSING APPLICATIONS TO RESOURCE PROBLEMS IN SOUTH DAKOTA Annual Progress Report, 1 Jul. 1977 - Jul. 1978
Victor I. Myers, Principal Investigator, R. G. Best, K. J. Dalsted, M. E. DeVries, J. C Eidenshink, F. A. Schmer, J. T. StreckFuss, and M. E. Wehde 1 Jul. 1978 127 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(Grant NGL-42-003-007)
(E79-10089; NASA-CR-157981; SDSU-RSI-78-14) Avail: NTIS HC A07/MF A01 CSCL 08F

The author has identified the following significant results. Change in the vegetative structure was taking place in the Black Hills. Temporal analysis of the areal extent of open meadows was accomplished using black and white and color infrared aerial photography. A reduction of nearly 1100 hectares of open meadows was determined using photointerpretation. Techniques were developed for the management of meandering lakes, including use of LANDSAT imagery for continuous monitoring, classification of hydrophytes on low altitude CIR imagery, and planning and evaluation of improvements and multiple uses on aerial photography and photo mosaics. LANDSAT data were analyzed statistically from small and entire study scene areas to determine the effect of soils stratifications of corn signatures. Band 5 early season and band 7 later season recorded the strongest evidence of the influence of soils on corn signatures. Significant strata were determined by a multiple range test.

N79-15368*# Virginia Inst. of Marine Science, Gloucester Point.
APPLICATIONS OF REMOTE SENSING TO ESTUARINE MANAGEMENT Annual Report
John C. Munday, Jr., Principal Investigator and Hayden H. Gordon Jun. 1978 69 p refs ERTS
(Grant NGL-47-022-005)
(E79-10090; NASA-CR-157982; AR-6) Avail: NTIS HC A04/MF A01 CSCL 08C

There are no author-identified significant results in this report.

N79-15369*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
THE LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). AN APPLICATION OF REMOTE SENSING BY MULTISPECTRAL SCANNERS
R. Bryan Erb, Principal Investigator 1975 12 p refs Sponsored by NASA, NOAA, and USDA Original contains color illustrations EREP
(E79-10091; NASA-CR-157983) Avail: NTIS HC A02/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N79-15370*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
ISODATA: THRESHOLDS FOR SPLITTING CLUSTERS
Edwin P. F. Kan, Principal Investigator Jan. 1972 38 p refs Sponsored by NASA ERTS
(E79-10092; NASA-CR-151544; LEC/HASD-640-TR-058) Avail: NTIS HC A03/MF A01 CSCL 02C

The author has identified the following significant results. The parameter AD (average distance) as used in the ISODATA program was critically examined. Thresholds of AD to decide on the splitting of clusters were obtained. For the univariate case, 0.84 was established as a sound choice, after examining several simple, as well as composite, distributions and also after investigating the probability of misclassification when points have to be reassigned to the newly identified clusters. For the multivariate case, the empirical threshold (N-0.16)/square root of N was extrapolated. A final criticism on AD was that AD would lose its effectiveness as a discriminative measure for the present purpose when N was large.

N79-15371*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SEASAT A. OCEANOGRAPHY TODAY
[1978] 15 p Sponsored by NASA Original contains color illustrations
(NASA-CR-158064) Avail: NTIS HC A02/MF A01 CSCL 08C

The mission, orbital flight, and onboard instrumentation of Seasat A are described. F.O.S.

N79-15372*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LANDSAT WORLD STANDARD CATALOG, LANDSAT-3 Monthly Report, 1 - 31 Oct. 1978
Oct. 1978 167 p

(NASA-TM-79968; GSFC/LWC3-78/10; NTISUB/D/277-010) Avail: NTIS HC A08/MF A01 CSCL 05B

Imagery acquired by LANDSAT 3 which was processed and input to the data files during the referenced month is listed. Data, such as data acquired, cloud cover, and image quality are given for each scene. The microfilm roll and frame on which the scene may be found is also given. G.G.

N79-15373# Forschungsinstitut fuer Informationsverarbeitung, Karlsruhe (West Germany).

SEMIAUTOMATIC EXTRACTION OF ROADS FROM AERIAL PHOTOGRAPHS Final Technical Report, 15 May 1977 - 15 Apr. 1978

W. Kestner Jun. 1978 50 p refs

(Grant DA-ERO-77-G-044; DA Proj. 1T1-61102-BH-57)

(AD-A060065) Avail: NTIS HC A04/MF A01 CSCL 14/5

Three different methods have been developed for the semiautomatic extraction of roads from aerial photographs. The interpreter has to initialize the procedures by defining parameter values and starting points on the roads. The results of the extraction procedures are displayed immediately for control and necessary correction by the interpreter. All three methods are described in principle, while one of them is described in detail. Test material for the methods had been provided by USAETL. Test results are shown and serve to explain the abilities and limits of the extraction methods. An assessment of the methods and discussions of further work conclude this report.

Author (GRA)

N79-15374# SRI International Corp., Menlo Park, Calif.

A PLAN FOR COMPARING THE TRIANGULATED IRREGULAR NETWORKS (TIN) AND UNIFORM RECTANGULAR GRID (URG) METHODS OF DIGITAL TERRAIN MODELING

William H. Frye Jul. 1978 30 p

(Contract N00014-77-C-0698; SRI Proj. 6726)

(AD-A060497) Avail: NTIS HC A03/MF A01 CSCL 08/2

Digital terrain modeling (DTM) is concerned with the digital storage, analysis, and display of surface configuration data (x,y,z) for topographic mapping. The field of DTM is relatively new and growing. Many methods of DTM have been studied and applied to real problems, but two are of concern here: the uniform rectangular grid (URG) and the triangulated irregular network (TIN) methods. This technical note presents preliminary evaluation methodology that will be used to compare the TIN and URG methods in the specific context of Marine Corps ground combat operations. GRA

N79-15375# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Electrical and Systems Engineering.

THE GENERALIZED CHAIN CODE FOR MAP DATA ENCODING AND PROCESSING

Herbert Freeman Jun. 1978 33 p refs

(Grant AF-AFOSR-2937-76)

(AD-A060690; CRL-59; AFOSR-78-1366TR) Avail: NTIS HC A03/MF A01 CSCL 08/2

The concept of chain coding for map data based on the well-known 8-direction coding matrix is generalized to coding schemes involving 16, 24, 32, 48 and even more permissible directions for the line segment links in the chain representation. General methods for quantization and encoding are described. The different schemes are compared with respect to compactness, precision, smoothness, simplicity of encoding, and facility for processing. The resulting coding schemes appear to have desirable characteristics for map data processing applications because of their improved storage efficiency, smoothness, and reduced processing time requirements. Author (GRA)

N79-15376# California Univ., Berkeley. Inst. of Urban and Regional Development.

COLLABORATIVE LAND-USE PLANNING FOR THE COASTAL ZONE. VOLUME 1: A PROCESS FOR LOCAL PROGRAM DEVELOPMENT

Thomas Dickert and Jens Sorensen Mar. 1978 139 p refs 2 Vol.

(Grant NOAA-04-6-158-44110)

(PB-287318/0; IMR-76-14; Sea-Grant-Pub-52-Vol-1; NOAA-78090602-Vol-1) Avail: NTIS HC A07/MF A01 CSCL 13B

The two volume monograph reports on research conducted during the past three years. Research was aimed at developing methods for managing the cumulative impact of coastal development and evaluating the operability of the collaborative planning process as mandated by the California Coastal Act. The rationale for collaborative planning is presented as well as the procedural steps in California's collaborative approach. A means of relating subregional and local coastal planning as well as proposed analytical steps for local coastal program development is discussed. GRA

N79-15377# California Univ., Berkeley. Inst. of Urban and Regional Development.

COLLABORATIVE LAND-USE PLANNING FOR THE COASTAL ZONE. VOLUME 2: HALF MOON BAY CASE STUDY

Dec. 1976 293 p refs 2 Vol.

(Grant NOAA-04-6-158-44021)

(PB-287319/8; IMR-76-15; Sea-Grant-Pub-53-vol-2; NOAA-78090603-Vol-2) Avail: NTIS HC A13/MF A01 CSCL 13B

The application of the collaborative planning process and related analytical methods to the Half Moon Bay subregion of San Mateo County, California are illustrated. The Half Moon Bay case study covers 58 square miles and includes the city of Half Moon Bay, the unincorporated communities of Montara, El Granada, and Moss Beach, and rural lands in San Mateo County. A procedure for determining a local government's existing commitment to growth and comparing that commitment to the level of development indicated by Coastal Policies is presented. Methods for analyzing the existing and potential capacities of water supply and waste water systems and a process for allocation of system capacity consistent with Coastal Policies were also examined. GRA

N79-15378# NATO Committee on the Challenges of Modern Society, Brussels (Belgium).

REMOTE SENSING FOR THE CONTROL OF MARINE POLLUTION. PRELIMINARY INVENTORY OF AVAILABLE TECHNOLOGIES

Jean-Marie Massin, ed. Mar. 1978 343 p In ENGLISH and FRENCH

(PB-286223/3; NATO/CCMS-78) Avail: NTIS HC A15/MF A01 CSCL 14B

Damage to the marine environment due to oil spills at sea are considered to be one of the main sources of pelagic pollution: at the present time, it is estimated that more than six million tons of hydrocarbons enter the marine environment as a result of shipping and certain coastal, industrial and urban activities, riverborne pollution, oil prospecting and mining at sea and, finally, natural seepage from certain sea bottoms. The rapid development of techniques and the multiplicity of studies and research undertaken, particularly with a view to developing integrated remote detection systems to meet the overall requirements of users, it was found desirable to take stock of present knowledge in this field (excluding satellites for the time being) so that the lines to be followed in the mentioned areas can be determined and assessed. GRA

N79-15379# Lockheed Electronics Co., Inc., Las Vegas, Nev. Remote Sensing Lab.

REMOTE MONITORING OF COAL STRIP MINE REHABILITATION Final Report, 1 Jul. 1975 - 31 Dec. 1976

James E. Anderson and Charles E. Tanner Jul. 1978 71 p refs

(Contract EPA-68-03-2636)

(PB-286647/3; EPA-600/7-78-149) Avail: NTIS HC A04/MF A01 CSCL 08I

The results of manual photointerpretation and automated data analysis are discussed. Included is a feasibility study to use LANDSAT data for performing a regional land-cover classification of a portion of the Powder River Basin area in northeastern Wyoming, where there are numerous coal strip mines. GRA

N79-15380# Georgia Inst. of Tech., Atlanta.

AN EVALUATION OF THE EFFECT OF DRAWDOWN ON

THE TROPHIC STATUS OF A SMALL RESERVOIR Final Report, 1 Jan. 1976 - 31 Aug. 1977
E. H. Barman, Jr. and David G. Baarda Jan. 1978 85 p refs Prepared in cooperation with Georgia College, Milledgeville
(Contract DI-14-31-0001-5010)
(PB-286328/0; ERC-01-78; W78-11576;OWRT-A-062-GA(1)) Avail: NTIS HC A05/MF A01 CSCL 13B

An evaluation of physical lake drawdown as a method of restoring small, eutrophic lakes and reservoirs was undertaken. Lake Laurel, a 5.4 ha reservoir in central Georgia, was drained and the sediments exposed to drying and erosion for six months. Before drawdown, determinations of dissolved oxygen, biochemical oxygen demand, turbidity, sulfide, nitrogen, phosphorus, and iron were undertaken. Biological parameters considered were distribution and relative abundance of benthic macro-invertebrates, phytoplankton biomass, and periphyton productivity. A post-drawdown evaluation of the same parameters was undertaken during corresponding time periods. GRA

N79-15381*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LANDSAT 2 WORLD STANDARD CATALOG, 1-31 OCTOBER 1978
Oct. 1978 91 p
(NASA-TM-79900; NTISUB/D/276-010; GSFC/LWC2-78/10) Avail: NTIS HC A05/MF A01 CSCL 05B

The World Standard Catalog lists imagery acquired by LANDSAT 2 which was processed and input to the data files during the referenced period. Information such as cloud cover and image quality is given for each scene. The microfilms roll and frame on which the scene may be found is also given.
Author

N79-15382*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LANDSAT 3 WORLD STANDARD CATALOG, 1-30 NOVEMBER 1978
Nov. 1978 247 p
(NASA-TM-80018; NTISUB/D/277-011; GSFC/LWC3-78/11) Avail: NTIS HC A11/MF A01 CSCL 05B

The World Standard Catalog lists imagery acquired by LANDSAT 3 which was processed and input to the data files during the referenced period. Information such as cloud cover and image quality is given for each scene. The microfilm roll and frame on which the scene may be found is also given.
Author

N79-15383*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LANDSAT 2 WORLD STANDARD CATALOG, 1-30 NOVEMBER 1978
Nov. 1978 61 p
(NASA-TM-79899; NTISUB/D/276-011; GSFC/LWC2-78/11) Avail: NTIS HC A04/MF A01 CSCL 05B

The World Standard Catalog lists imagery acquired by LANDSAT 2 which was processed and input to the data files during the referenced period. Information such as cloud cover and image quality is given for each scene. The microfilm roll and frame on which the scene may be found is also given.
Author

N79-15384# Federation of Rocky Mountain States, Inc., Denver, Colo. Information Systems Technical Lab.
COMPARISON OF SELECTED OPERATIONAL CAPABILITIES OF FIFTY-FOUR GEOGRAPHIC INFORMATION SYSTEMS
Larry Salmen, James Gropper, John Hamill, and Carl Reed Sep. 1977 30 p refs
(Contract DI-14-16-0008-2155)
(PB-286977/4; FWS/OBS-77/54; LC-77-90894) Avail: NTIS HC A03/MF A01 CSCL 08G

The initial evaluation results are presented for off the shelf computer software that may possibly contribute to a system which processes and outputs spatially related data for the U.S. Fish and Wildlife Service. Two sets of criteria were considered: operational criteria referring to the general hardware and software characteristics of a particular program, and functional criteria referring to the actual logical function on tasks performed by specific software. GRA

N79-15385# Geological Survey, Harrisburg, Pa. Water Resources Div.
WATER RESOURCES DATA FOR PENNSYLVANIA, WATER YEAR 1977, VOLUME 1. DELAWARE RIVER BASIN Annual Report, 1 Oct. 1975 - 30 Sep. 1976
Jun. 1978 373 p
(PB-286880/0; USGS/WRD/HD-78/031; USGS/WDR/PA-77/1) Avail: NTIS HC A16/MF A01 CSCL 08H

Water resources data for the 1977 water year for Pennsylvania consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of ground water. Discharge records for 82 gaging stations; stage and contents for 10 lakes and reservoirs; water quality for 34 gaging stations, 41 partial-record stations, and water levels for 16 observation wells are presented. Also included are 42 crest-stage partial-record stations and 38 low-flow partial-record stations. These data represent that part of the national water data system collected by the U.S. Geological Survey and cooperating State and Federal agencies in Pennsylvania. GRA

N79-15386# Municipal Environmental Research Lab., Cincinnati, Ohio.
STREAM MODELS FOR CALCULATING POLLUTIONAL EFFECTS OF STORMWATER RUNOFF Progress Report, Jan. - Dec. 1977
Robert Smith and Richard G. Eilers Aug. 1978 110 p refs
(PB-286930/3; EPA-600/2-78-148) Avail: NTIS HC A06/MF A01 CSCL 08H

Three related studies are described which provide the means to quantify the pollutional and hydraulic effects on flowing streams caused by stormwater runoff. Mathematical stream models were developed to simulate the biological, physical, chemical, and hydraulic reactions which occur in a stream. Relationships take the form of differential equations with the two independent variables of time and distance. The differential equations can be solved directly by means of calculus or by digital computer using numerical methods. The solution would be the concentration of species of pollutional interest, such as BOD and dissolved oxygen, within the stream as a function of distance and time. GRA

N79-15387# National Geodetic Survey, Rockville, Md.
SURVEY OF THE MCDONALD OBSERVATORY RADIAL LINE SCHEME BY RELATIVE LATERATION TECHNIQUES
William E. Carter and T. Vincenty Jun. 1978 40 p refs Sponsored by NOAA
(PB-287427/9; NOAA-TR-NOS-74; NGS-9; NOAA-78091501) Avail: NTIS HC A03/MF A01 CSCL 08E

During May and June 1977, the National Ocean Survey/National Geodetic Survey (NOS/NGS) performed a special survey in the vicinity of the University of Texas McDonald Observatory. An important part of the study plan is the monitoring, by periodic resurveys, of any changes in the lengths of a radial pattern of lines that are as long as 93 km. A method of relative lateration, the 'ratio method', using electromagnetic distance measurements is being tested. This paper contains descriptive information about the methods employed in the collection, reduction, and analysis of the survey data, tabulations of the observational data, and the numerical and interpretive results of our analyses. GRA

N79-15388# National Geodetic Survey, Rockville, Md.
THE STATE COORDINATING SYSTEMS. A MANUAL FOR SURVEYORS
Hugh C. Mitchell and Lansing G. Simmons Mar. 1978 74 p refs Sponsored by NOAA
(PB-287438/6; SP-235; NOAA-78091801) Avail: NTIS HC A04/MF A01 CSCL 08B

Only plane surveying methods and formulas are employed. The State coordinate systems are described, and procedures which their use involves are explained and exemplified by carrying through the computation of a farm survey. The several appendices contain essential information relating to the State systems themselves; a report on their adoption by legislative enactment;

and some formulas and tables which will aid in placing a land survey on a State system. GRA

N79-15389# Bureau of Reclamation, Denver, Colo. Engineering and Research Center.

SIMAZINE RESIDUES IN CANAL WATER AND CROPS RESULTING FROM EXPERIMENTAL APPLICATION FOR DITCHBANK WEED CONTROL

J. C. Pringle, Lars W. J. Anderson, N. E. Otto, R. W. Raines, and U. T. Jackson May 1978 36 p refs Prepared in cooperation with Agricultural Res. Sys., Denver, Colo. and Fish and Wildlife Sys., Denver, Colo.

(PB-287173/9; REC-78-1) Avail: NTIS HC A03/MF A01 CSCL 07D

A field study was initiated during 1976 to determine the amount of simazine (2-chloro-4,6-bis-(ethylamino)-s-triazine) likely to be found in irrigation water following ditchbank treatment for weed control. Canals were selected in California, Colorado, and Washington State for the application of simazine to both watered and dewatered sites at rates of 2.25 kg/ha and 4.5 kg/ha. Immediately following herbicide application, simazine levels detected in flowing canal water did not exceed 60 micrograms/L. First flow samples collected in the spring of 1977, from the dry application sites, peaked at 250 micrograms/L within the treated section but dropped rapidly less than 5 micrograms/L. GRA

N79-15390# Permutit Co., Inc., Princeton, N. J. Research and Development Center.

INCREASED PRODUCT WATER RECOVERY BY REVERSE OSMOSIS USING INTERSTAGE ION EXCHANGE SOFTENING AND A SPIRACTOR

A. B. Mindler and S. T. Bateman 20 Jun. 1978 31 p refs (Contract DI-14-34-0001-7554; OWRT Proj. S-0124(7554)(1)) (PB-287920/3; W79-00301) Avail: NTIS HC A03/MF A01 CSCL 07D

Pilot plant test results are discussed in which 67 percent increased water recovery was obtained from simulated reverse osmosis (RO) concentrate of high calcium-high sulfate water similar to projected Yuma Desalination Facility reject operated at 70 percent recovery; i.e. an overall recovery of 90 percent. The self-sustaining system consisted of ion exchange softening of interstage concentrate using as regenerant salt, only the final reject from Secondary RO and no imported salt. No antiscalant was used for protection of either the IX or RO systems. The level of regeneration was enhanced by reuse of previously used regenerant, desupersaturated with respect to gypsum by a fluidized seed bed crystallizer, a spiractor. GRA

N79-15391# Economic Evaluation Associates, Inc., Chicago, Ill.

AN ECONOMIC ANALYSIS OF PHOSPHOROUS CONTROL AND OTHER ASPECTS OF R76-1 Final Report

James E. Ciecka, Robert G. Fabian, Daniel S. Merilatt, and Thomas J. Murphy (De Paul Univ.) Jun. 1978 125 p refs Sponsored by Illinois Inst. for Environmental Quality

(PB-286839/6; IIEQ-78-16) Avail: NTIS HC A06/MF A01 CSCL 08H

On January 5, 1976, the Illinois Environmental Protection Agency proposed an amendment to the Water Pollution Control Regulations (Chapter 3) which: (1) deletes the general water quality standard for phosphorus of 0.05 mg/1, and (2) adds a new effluent standard for phosphorus (1.0 mg/1) for discharges affecting lakes and reservoirs of 20 acres or larger. In addition, the proposed amendment would change certain portions of the effluent standards to make them compatible with the National Pollution Discharge Elimination System. These latter changes are largely administrative, with no significant environmental or economic consequences. GRA

N79-15392# Nevada Univ. System, Reno. Water Resources Center.

HYDROLOGIC INVENTORY AND EVALUATION OF NEVADA PLAYAS

Richard L. Bateman and John W. Hess Jan. 1978 69 p refs Sponsored in part by Dept. of Interior

(OWRT Proj.-A-070-NEV(1))

(PB-286327/2; W78-11573) Avail: NTIS HC A04/MF A01 CSCL 08H

One hundred and fifteen major playas greater than 0.25 sq mi in area were identified and catalogued in the state of Nevada. They are located throughout the state in areas of internal drainage. This average playa size is 18 sq mi with the largest being approximately 450 sq mi in area. Sixty-eight (59%) of the playas actively discharge groundwater; many are terminal discharge sites. Depth to groundwater may be in excess of 1000 ft under some of these dry playas. Groundwater quality, as measured by specific electrical conductivity, ranges from approximately 1000 micromhos/cm associated with some nondischarging playas to greater than 100,000 micromhos/cm in several discharging playas. Playa surfaces range from dry, hard and smooth through salt or evaporite crusts to very porous, puffy and sticky. GRA

N79-15393# Wyoming Univ., Laramie.

LAND APPLICATION OF WASHWATER UNDER HIGH ALTITUDE CONDITIONS Final Report, 1975 - 1978

John Borrelli, Robert D. Burman, Ronald H. Delaney, Joseph L. Moyer, and Hugh W. Hough Jul. 1978 107 p refs (Grant EPA-R-803571)

(PB-286174/8; EPA-600/2-78-139) Avail: NTIS HC A06/MF A01 CSCL 08H

The nutrient, crop, and hydrologic parameters affecting the Thayne, Wyoming, wastewater treatment system were monitored and evaluated. Cheeseplant wastewater and municipal sewage were mixed, pretreated, and applied to a 15 hectare spayfield on a year-round basis. An ice pack formed during November or December, depending on weather conditions, and lasted through the middle of April. Samples of groundwater and water from adjacent springs show that after three consecutive years (1975-1977) of spraying wastewater on the field and with a build-up of the ice pack each winter, no significant amounts of pollutants reached the groundwater. Reduction of BOD5, COD, and nitrogen forms to migrate in the ice pack was observed. The forages studied could, at specific stages of growth, contain sufficient NO3-N to be toxic to livestock. GRA

N79-15394# Kansas State Geological Survey, Lawrence.

THE ORIGIN OF SURFACE LINEAMENTS IN NEMAHA COUNTY, KANSAS

Susan M. DuBois Aug. 1978 58 p refs (Contract NRC-04-77-017)

(PB-287302/4; NUREG-CR-0321) Avail: NTIS HC A04/MF A01 CSCL 08G

The geology and seismicity of Kansas was examined in connection with design criteria for dams, nuclear power plants, and other earthquake-sensitive structures. A search for surface lineaments was conducted using LANDSAT-MSS and side-looking airborne radar imagery as well as conventional and satellite photography. The origin of the surface lineaments observed in Nemaha County and portions of the surrounding counties in Kansas and Nebraska was investigated. GRA

N79-15395# Fish and Wildlife Service, Ft. Collins, Colo. Western Energy and Land Use Team.

STREAM CLASSIFICATION 1977: PROCEEDINGS OF A WORKSHOP

Terry T. Terrell and William J. McConnell Apr. 1978 54 p Conf. held at Pingree Park, Colo., 10-13 Oct. 1977

(PB-286171/4; FWS/OBS-78/23) Avail: NTIS HC A04/MF A01 CSCL 08H

An outline for the accurate development of useful stream classifications is provided. The three major points considered were: the purposes of classification, the principles necessary to insure the usefulness of a classification, and the processes of developing and sequencing of components in a useful classification. An outline was provided for the development of stream classifications, but a major caution was noted. No classification can answer all the questions one might ask concerning management and use of streams. Judgement must be used in the choice, construction, and use of stream classifications. GRA

N79-15396# Alaska Univ., Fairbanks. Inst. of Water Resources.

SNOWMELT-FROZEN SOIL CHARACTERISTICS FOR A SUBARCTIC SETTING Final Report

Douglas L. Kane, Richard D. Seifert, John D. Fox, and George

S. Taylor Jan. 1978 71 p refs
(Contract DI-14-34-0001-7004; OWRT Proj. A-054-ALAS(1))
(PB-286093/0; IWR-84) Avail: NTIS HC A04/MF A01 CSCL 08H

The pathways of soil water in cold climates are influenced, in addition to the normal forces, by the presence of permafrost and the temperature gradients in the soil system, whereas the infiltration of surface water into the soil system is a function of moisture levels, soil type and condition of the soil (whether it is frozen or not). Snowfall, with subsequent surface storage over a period of several months, typifies Alaskan winters. The melt period represents an event when large quantities of water may enter the soil system; the possibilities exist for recharging the groundwater system, or else generating surface runoff. The objective of this study was to determine the magnitude of potential groundwater recharge from snowmelt. GRA

N79-15397# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Systems Engineering.
ANALYTICAL FRAMEWORK FOR THE DESIGN OF DATA COLLECTION SYSTEMS THAT ARE RESPONSIVE TO THE NEEDS OF PLANNING AND MANAGEMENT OF WATER RESOURCES AND RELATED LAND SYSTEMS Final Report
Yacov Y. Haimes, Jim Craig, and Jayram Subrahmanian May 1978 311 p refs
(Grant DI-14-31-0001-5202)
(PB-286919/6; W78-12388; OWRT Proj. C-6027(5202)(1)) Avail: NTIS HC A14/MF A01 CSCL 13B

This report consists of three parts: In the first part, a decomposition approach is proposed for the optimal sequencing of water supply projects constructed to meet a projected demand function. A procedure based upon decomposition, dynamic programming, and incremental cost considerations is developed to permit effective analysis of systems, previously considered dimensionally infeasible. In the second part of the report, a methodology is presented for determining the worth of stream flow data used to estimate future yields of proposed water supply projects. The third part of the report is devoted to a case study in which the worth of stream flow data is determined with respect to capacity expansion of a system consisting of six candidate projects. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N79-15398# Committee on Interstate and Foreign Commerce (U. S. House).
THE NATIONAL ENERGY PLAN: OPTIONS UNDER ASSUMPTIONS OF NATIONAL SECURITY THREAT
Washington GPO 1978 411 p refs Rept. with selected readings for use by the Subcomm. on Energy and Power of the Comm. on Interstate and Foreign Commerce, 95th Congr., 2d Sess., Apr. 1978 Prepared by Library of Congr., Congressional Res. Service
(H-Print-95-48; GPO-23-434) Avail: SOD HC

The dependence of the United States and the free world on imported oil places free world economic, political, and military wellbeing at grave near term risk, and requires an accelerated program to reduce oil import dependence and a shift to other fuels, all with the equivalent of wartime urgency, vigor, and scale. The types of programs and rationales that would be consistent with a credible near term threat are explored using analogous or comparable war-related mobilizations in the past. A.R.H.

N79-15399# Committee on Interstate and Foreign Commerce (U. S. House).
THE NATIONAL ENERGY PLAN: OPTIONS UNDER ASSUMPTIONS OF NATIONAL SECURITY THREAT OR ENERGY POLICY AS IF IT REALLY MATTERED
Washington GPO 1978 29 p refs Rept. for the Subcomm. on Energy and Power of the Comm. on Interstate and Foreign Commerce and for the Subcomm. on Energy, Nuclear Proliferation, and Federal Services of the Comm. on Governmental Affairs, 95th Congr., 2d Sess., Mar. 1978 Prepared by the Library of Congr., Congressional Res. Service
(H-Print-95-42; GPO-23-442) Avail: Subcomm. on Energy and Power

In response to a congressional request, the types of programs and rationales that would be consistent with a credible, near-term national security threat are explored, based upon analogous or comparable war-related mobilizations in the past. This analysis does not assess the relative merits of the President's projection of national security threat of crisis dimensions against other less drastic interpretations but accepts that projection and the need for wartime emergency measures as assumptions for this paper. Author

N79-15400# Committee on Interstate and Foreign Commerce (U. S. House).
US ENERGY DEMAND AND SUPPLY, 1976-1985: LIMITED OPTIONS, UNLIMITED CONSTRAINTS Final Report
GPO 1978 154 p refs Rept. for use of the Subcomm. on Energy and Power of the Comm. on Interstate and Foreign Commerce, 95th Congr., 1st Sess., Mar. 1978 Prepared by Library of Congr., Congressional Res. Service
(H-Print-95-43; GPO-21-616) Avail: Subcomm. on Energy and Power

Studies made in 1974 indicating that the United States could be energy self-sufficient by 1985 at energy growth rates are now considered much too high by most energy analysts. More recent studies project that U.S. primary energy consumption will rise from about 74 quadrillion Btu (Q) in 1976, to between 81 and 85 Q in 1980; between 91 and 104 Q in 1985; and, between 105 and 116 Q by 1990. The National Energy Program is analyzed in terms of the theory of economic policy. The geological, technical, economic, and institutional barriers that must be overcome to increase domestic energy supplies for the year 1985 are discussed for the production of coal, natural gas, oil, nuclear power, synthetic fuels, and for solar, geothermal, and hydropower conversion and utilization. A.R.H.

N79-15401*# Wyle Labs., Inc., Huntsville, Ala. Solar Energy Div.
THERMAL PERFORMANCE EVALUATION OF THE SOLARGENICS SOLAR COLLECTOR AT OUTDOOR CONDITIONS
Dec. 1978 32 p ref Prepared for DOE
(Contract NAS8-32026)
(NASA-CR-150857) Avail: NTIS HC A03/MF A01 CSCL 10A

Test procedures used during the performance of an evaluation program are presented. The test program was conducted to obtain the following performance data and information on the solar collector. (1) thermal performance data under outdoor conditions; (2) structural behavior of collector under static conditions; (3) effects of long term exposure to material weathering elements. The solargenics is a liquid, single-glazed, flat plate collector. Approximate dimensions of each collector are 240 inches long, 36 inches wide, and 3.5 inches in depth. Author

N79-15402*# Sigma Research, Inc., Richland, Wash.
PASSIVE THERMOSYPHON SOLAR HEATING AND COOLING MODULE WITH SUPPLEMENTARY HEATING Quarterly Report
Oct. 1977 58 p refs Prepared for DOE
(Contract NAS8-32260)
(NASA-CR-150849) Avail: NTIS HC A04/MF A01 CSCL 10A

A collection of three quarterly reports from Sigma Research, Inc., covering progress and status from January through September 1977 are presented. Three heat exchangers are developed for use in a solar heating and cooling system for installation into single-family dwellings. Each exchanger consists

of one heating and cooling module and one submerged electric water heating element. S.E.S.

N79-15403*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

COMPARISON OF FUEL-CELL AND DIESEL INTEGRATED ENERGY SYSTEMS AND A CONVENTIONAL SYSTEM FOR A 500-UNIT APARTMENT

Stephen N. Simons and William L. Maag Nov. 1978 26 p refs

(NASA-TM-79037; E-9835) Avail: NTIS HC A03/MF A01 CSCL 10B

The electrical and thermal energy utilization efficiencies of a 500 unit apartment complex are analyzed and compared for each of three energy supply systems. Two on-site integrated energy systems, one powered by diesel engines and the other by phosphoric-acid fuel cells were compared with a conventional system which uses purchased electricity and on-site boilers for heating. All fuels consumed on-site are clean, synthetic fuels (distillate fuel oil or pipeline quality gas) derived from coal. Purchased electricity was generated from coal at a central station utility. The relative energy consumption and economics of the three systems are analyzed and compared. Author

N79-15404*# Owens-Illinois, Inc., Toledo, Ohio.

DESIGN DATA BROCHURE FOR THE OWENS-ILLINOIS SUNPAK (TM) AIR-COOLED SOLAR COLLECTOR

Dec. 1978 13 p ref Prepared for DOE

(Contract NAS8-32259)

(NASA-CR-150868) Avail: NTIS HC A02/MF A01 CSCL 10A

Information necessary to evaluate the design and installation of the Owens-Illinois Sunpak TM Air-Cooled Solar Collector is presented. Information includes collector features, fluid flow, thermal performance, installation and system tips. The collector utilizes a highly selective wavelength coating in combination with vacuum insulation, which virtually eliminates conduction and convention losses. L.S.

N79-15405*# Solar Designs, Taylors, South Carolina.

SOLAR HOT WATER SYSTEM INSTALLED AT ANDERSON, SOUTH CAROLINA Final Report

Dec. 1978 37 p Sponsored in part by NASA

(Contract DOE-77-G-01-1663)

(NASA-CR-150856) Avail: NTIS HC A03/MF A01 CSCL 10A

A description is given of the solar energy hot water system installed in the Days Inns of America, Inc., at Anderson, South Carolina. The building is a low-rise, two-story 114-room motel. The solar system was designed to provide 40 percent of the total hot water demand. The collector is a flat plate, liquid with an area of 750 square feet. Operation of this system was begun in November 1977, and has performed flawlessly for one year. Author

N79-15406*# Reynolds Metals Co., Richmond, Va. Product Development Div.

SOLAR HEATING AND HOT WATER SYSTEM INSTALLED AT LISTERHILL, ALABAMA

Dec. 1978 134 p Sponsored by NASA

(Contract DOE-G-77-A-01-4070)

(NASA-CR-150870) Avail: NTIS HC A07/MF A01 CSCL 10A

The Solar system was installed into a new building and was designed to provide 79% of the estimated annual space heating load and 59% of the estimated annual potable hot water requirement. The collectors are flat plate, liquid manufactured by Reynolds Metals Company and cover a total area of 2344 square feet. The storage medium is water inhibited with NALCO 2755 and the container is an underground, unpressurized steel tank with a capacity of 5000 gallons. This report describes in considerable detail the solar heating facility and contains detailed drawings of the completed system. Author

N79-15407*# Naval Weapons Support Center, Crane, Ind. Weapons Quality Engineering Center.

INITIAL EVALUATION TESTS OF EAGLE-PICHER INDUSTRIES 9.0 AMPERE-HOUR NICKEL-CADMIUM SPACECRAFT CELLS FOR THE HEAT CAPACITY MAPPING MISSION SATELLITE AND THE STRATOSPHERIC AEROSOL AND GAS EXPERIMENT SATELLITE

J. D. Harkness 16 Jan. 1978 17 p

(NASA Order S-53742-AG)

(NASA-CR-159907; WQEC/C-78-37) Avail: NTIS HC A02/MF A01 CSCL 10C

The results of tests to insure that all cells put into the life cycle program are of high quality are reported. The tests consisted of the following: phenolptalein leak tests, internal short test, charge efficiency test, and overcharge tests. The results of tests for 10 cells are tabulated. F.O.S.

N79-15408*# Naval Weapons Support Center, Crane, Ind. Weapons Quality Engineering Center.

INITIAL EVALUATION TESTS OF GENERAL ELECTRIC COMPANY 26.5 AMPERE-HOUR NICKEL-CADMIUM SPACECRAFT CELLS WITH AUXILIARY ELECTRODES FOR THE TIROS-N AND NOAA-A SATELLITES

J. D. Harkness 16 Jan. 1978 14 p

(NASA Order S-53742-AG)

(NASA-CR-159906; WQEC/C-78-2) Avail: NTIS HC A02/MF A01 CSCL 10C

This evaluation test program had the purpose to insure that all cells put into the life cycle program are of high quality by the screening of cells found to have electrolyte leakage, internal shorts, low capacity, or inability of any cell to recover its open-circuit voltage above 1.150 volts during the internal short test. Test limits specify those values at which a cell is to be terminated from charge or discharge. Requirements are referenced to as normally expected values based on past performance of aerospace nickel-cadmium cells with demonstrated life characteristics. A requirement does not constitute a limit for discontinuance from test. G.Y.

N79-15409*# Honeywell, Inc., Minneapolis, Minn. Energy Resources Center.

PRELIMINARY DESIGN PACKAGE FOR PROTOTYPE SOLAR HEATING AND COOLING SYSTEMS

Dec. 1978 296 p Prepared for DOE

(Contract NAS8-32093)

(NASA-CR-150853) Avail: NTIS HC A13/MF A01 CSCL 10A

A summary is given of the preliminary analysis and design activity on solar heating and cooling systems. The analysis was made without site specific data other than weather; therefore, the results indicate performance expected under these special conditions. Major items include a market analysis, design approaches, trade studies and other special data required to evaluate the preliminary analysis and design. The program calls for the development and delivery of eight prototype solar heating and cooling systems for installation and operational test. Two heating and six heating and cooling units will be delivered for Single Family Residences, Multiple-family Residences and commercial applications. Author

N79-15410*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

BENEFITS OF SOLAR/FOSSIL HYBRID GAS TURBINE SYSTEMS

Harvey S. Bloomfield 1978 18 p refs Proposed for Presentation at the Gas Turbine Conf. and Solar Energy Conf., San Diego, Calif., 12-15 Mar. 1979; sponsored by Am. Soc. of Mech. Engr.

(NASA-TM-79083; E-9905) Avail: NTIS HC A02/MF A01 CSCL 10A

The potential benefits of solar/fossil hybrid gas turbine power systems were assessed. Both retrofit and new systems were considered from the aspects of; cost of electricity, fuel conservation, operational mode, technology requirements, and fuels flexibility. Hybrid retrofit (repowering) of existing combustion (simple Brayton cycle) turbines can provide near-term fuel savings and solar experience, while new and advanced recuperated or combined cycle systems may be an attractive fuel saving and economically competitive vehicle to transition from today's gas and oil-fired powerplants to other more abundant fuels. Author

N79-15411*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PHOTOVOLTAIC POWER SYSTEMS FOR RURAL AREAS OF DEVELOPING COUNTRIES
Louis Rosenblum, William J. Bifano, Gerald F. Hein, and Anthony F. Ratajczak 1979 19 p refs Presented at the Intern. Seminar on Solar Energy, Tokyo, 5-10 Feb. 1979; sponsored by the United Nations and Govt. of Japan
(NASA-TM-79097; E-9921) Avail: NTIS HC A02/MF A01 CSCL 10A

Systems technology, reliability, and present and projected costs of photovoltaic systems are discussed using data derived from NASA, Lewis Research Center experience with photovoltaic systems deployed with a variety of users. Operating systems in two villages, one in Upper Volta and the other in southwestern Arizona are described. Energy cost comparisons are presented for photovoltaic systems versus alternative energy sources. Based on present system technology, reliability, and costs, photovoltaics provides a realistic energy option for developing nations. A.R.H.

N79-15412# Aerospace Corp., El Segundo, Calif. Ivan A. Getting Labs.
TRANSIENT TECHNIQUES FOR LOW FREQUENCY BATTERY IMPEDANCE MEASUREMENTS Interim Report
Albert H. Zimmerman and Michael R. Martinelli 6 Oct. 1978 22 p refs
(Contract F04701-78-C-0079)
(AD-A060880; TR-0079(4970-10)-1; SAMSO-TR-78-134) Avail: NTIS HC A02/MF A01 CSCL 10/3

A general formalism is developed for obtaining battery impedances as a function of frequency from the time response to an input current step. As an example, this technique is applied to impedance measurements for a 10-ampere hour nickel cadmium satellite cell. The impedance over the frequency range of 0.5 Hz to ten to the minus 6th power Hz is indicative of diffusion controlled cell polarization. Author (GRA)

N79-15413# Rocketdyne, Canoga Park, Calif.
DEVELOPMENT OF A HIGH ENERGY STORAGE FLYWHEEL MODULE Final Report, 30 Jun. 1975 - 30 May 1978
Donald R. Hodson 30 May 1978 159 p refs
(Contract DAAG53-75-C-0278)
(AD-A060351; RI/RD78-207) Avail: NTIS HC A08/MF A01 CSCL 10/3

A three-phase 35 month program was conducted to design and build a complete flywheel energy storage system rated at 30 KWH (40 HP-HRS) at 15,000 RPM. In the first phase, tradeoff studies were completed to select optimum materials, flywheel configuration, interface characteristics and to define performance characteristics. During the second phase, a detail design of the system was generated, including all drawings, specifications, and descriptive data. A subscale model of the fullscale flywheel was also fabricated and tested during phase 2. The third and final phase of the current program consisted of fabrication and assembly of the fullscale 30 KWH flywheel module and associated control equipment. All program hardware was stored at Rocketdyne pending decisions to proceed with test of the system identified as Rocketdyne model RS-31. Author (GRA)

N79-15414# Maxwell Labs., Inc., Woburn, Mass.
MAGNETOHYDRODYNAMIC LIGHTWEIGHT CHANNEL DEVELOPMENT Final Report, 28 Nov. 1975 - 31 Dec. 1977
D. W. Swallom, O. K. Sonju, D. E. Meader, and G. T. Heskey Jun. 1978 171 p refs
(Contract F33615-76-C-2001)
(AD-A060429; AFAPL-TR-78-41) Avail: NTIS HC A08/MF A01 CSCL 10/2

A lightweight, high performance MHD channel and diffuser were designed, built, and tested. The hardware was designed for testing with toluene and oxygen. The design power level of 200 kW dc was obtained during the 125 tests. The MHD channel design was a diagonal conducting wall generator with calcia stabilized zirconia electrodes and a filament wound epoxy coated fiberglass outer shell. The diffuser design utilized thin wall copper construction with external cooling tubes. These designs resulted in a significant reduction of the masses of the channel and diffuser. The masses of the channel and diffuser were 40 kg and 24 kg, respectively, which compared favorably to previous channels and diffusers of similar performance characteristics with masses of 160 kg and 150 kg, respectively. The novel design features of the channel construction technique included the use of a filament wound, epoxy coated fiberglass structural shell, the presence of an RTV layer to provide the pressure seal, and the minimization of the use of the copper material in the electrode frames. This fabrication procedure combined to provide a lightweight channel capable of withstanding sustained operation under a wide variety of operating conditions. GRA

N79-15415# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
SOME FATIGUE CHARACTERISTICS OF NICKEL BATTERY PLAQUE Interim Report, Nov. 1977 - Apr. 1978
David H. Fritts Jul. 1978 35 p refs
(AF Proj. 2303)
(AD-A060370; AFAPL-TR-78-37) Avail: NTIS HC A03/MF A01 CSCL 10/3

The conductance of sintered nickel battery plaque is experimentally determined as the plaque is being mechanically stressed. The plaque was subjected to bonding fatigue tests and to tensile testing. It was found that the plaque conductance exponentially decreases with bonding fatigue cycling. Also, it was determined that the plaque conductance is a function of its instantaneous state of stress. Author (GRA)

N79-15416# Electronics Engineering Group (1842nd), Scott AFB, Ill.
LEAD CALCIUM BATTERY CELL SERVICING AND CHARGING PROBLEMS AND PROCEDURES
Thomas A. Bennett 30 Sep. 1978 10 p
(AD-A060456; Rept-1842-EEG/EEIS-TR-78-15) Avail: NTIS HC A02/MF A01 CSCL 10/3

Lead calcium battery cell charging problems were experienced in the field. Record data was submitted for review and recommendations. This report provides an analysis of the problem and recommends servicing and initial charging procedures. Author (GRA)

N79-15417# Rome Air Development Center, Hanscom AFB, Mass.
DETECTION OF PROCESSING-AND RADIATION-INDUCED DEFECTS IN SOLAR CELLS BY TRANSIENT CAPACITANCE SPECTROSCOPY
P. J. Drevinsky, J. T. Schott, H. M. DeAngelis, A. R. Kirkpatrick (Spire Corp., Bedford, Mass.), and J. A. Minnucci (Spire Corp., Bedford, Mass.) 1978 9 p refs
(AD-A060085; RADC/ETR-78-0065) Avail: NTIS HC A02/MF A01 CSCL 10/2

A transient capacitance technique was used to detect processing- and radiation- induced defects in silicon solar cells fabricated with implanted junctions and annealed by either pulsed electron beam processing or by furnace treatment. Comparison was made with diffused junction cells. A carbon-related defect was detected in as-fabricated implanted, electron beam annealed cells. Transient capacitance spectra of electron-irradiated cells show this defect in the three types of cells as well as a boron-related minority carrier trap and the divacancy. Cell characteristics were measured. G.Y.

N79-15418# Virginia Commonwealth Univ., Richmond. Dept. of Physics.
OPTICAL PROPERTIES OF SEMICONDUCTORS: SOLAR CELL MATERIALS Final Report, 15 May - 15 Aug. 1978
Eugene Shiles 15 Aug. 1978 79 p refs
(Grant AF-AFOSR-3591-78)
(AD-A060640; AFOSR-78-1412TR) Avail: NTIS HC A05/MF A01 CSCL 10/2

The optical properties of the semiconductors silicon and gallium arsenide have been examined by a Kramers-Kronig analysis of the available experimental measurements of the optical constants (reflectivity, extinction coefficient, index of refraction, and dielectric function) for these materials. The results include the full range of optical electronic excitations, from infrared through X-rays, and have been examined by the evaluation of various sum rules. The sum rules are well satisfied by the resulting

silicon data, and the results are consistent with the various experimental measurements. There is some question concerning the data in the region of band-to-band transitions (visible and ultra-violet); the resolution must await further experimental measurements of reflectivity and/or dielectric function in this spectral range. The silicon work constitutes the first part of this report. For gallium arsenide, the sum rules analysis indicates that the available experimental measurements of the absorption of gallium and arsenic may be too small in the X-ray region at energies less than the onset of L-shell core electron excitations. Also the data is incomplete in the region just above the L-shell threshold. Comparison of the final results with various experimental measurements also indicate that the available normal-incidence reflectivity data in the region of band-to-band transitions may be inaccurate (values too small). The gallium arsenide calculation and the above mentioned problems are described in the second part of this report. The work is continuing, in an attempt to locate more experimental data and to define more closely the spectral regions where the presently available data is inaccurate. Author (GRA)

N79-15419# Naval Civil Engineering Lab., Port Hueneme, Calif.
PERFORMANCE OF LEAD-ACID GELLED ELECTROLYTE BATTERIES IN THE DEEP OCEAN ENVIRONMENT Final Report, Oct. 1977 - Sep. 1978
W. D. Briggs Sep. 1978 28 p ref
(ZF61512001)
(AD-A060422; CEL-TN-1526) Avail: NTIS HC A03/MF A01 CSCL 10/3

Standard lead-acid batteries with liquid electrolyte experience dramatic capacity losses when charged and discharged under deep ocean conditions. Recently developed commercial lead-acid batteries with gelled electrolyte were tested to determine their performance at high pressure and low temperature. Batteries from three manufacturers were divided into control and test groups. The test groups were modified to allow pressure compensation with white mineral oil. The performance of the test batteries was not degraded by exposure to the mineral oil or high pressure (10,000 psig). An average loss of capacity of 10% was experienced when the batteries were cycled cold (32 degree F) and at pressure (10,000 psig). However, this capacity loss is significantly less than the 35-70% loss experienced in previous tests with standard batteries in similar conditions. Thus, lead-acid batteries with gelled electrolyte were found to be suitable for use in deep ocean conditions in a pressure compensated mode.
Author (GRA)

N79-15420# Sandia Labs., Albuquerque, N. Mex.
PULSED POWER CONVERSION WITH INDUCTIVE STORAGE
E. C. Cnare, M. Cowan, T. P. Wright, and W. K. Tucker 1977 4 p refs Sponsored by DOE
(SAND-77-1733C; Conf-771029-129) Avail: NTIS HC A02/MF A01

The pulsar compressed magnetic flux, pulse power generator system has applications as a topping stage in commercial power generation. A plasma armature mode of operation is described which could be powered by an inertially confined fusion reactor. The development of a plasma armature is summarized along with experimental results from its application in a pulsar generator which utilizes a 0.5 m diameter superconducting magnet. A larger generator under construction which utilizes a 1 m diameter magnet is briefly described, and estimates of its performance are given. DOE

N79-15421# Missouri Dept of Natural Resources, Jefferson City.
LPG IN MISSOURI
1978 190 p refs
(PB-286329/8) Avail: NTIS HC A01/MF A01 CSCL 10A

A brief history of the LPG (Liquified Petroleum Gases) industry, the overall consumption and sector usage for both the U.S. and Missouri, the movement and storage of LPG, the future supply and demand, and the identification of various state and federal regulations are presented. GRA

N79-15422# Martin Marietta Labs., Baltimore, Md.
BIOLOGICAL SOLAR ENERGY CONVERSION: APPROACHES TO OVERCOME YIELD, STABILITY AND PRODUCT LIMITATIONS Progress Report, 1 Apr. - 30 Sep. 1977
Bessel Kok, C. F. Fowler, H. H. Hardt, and R. J. Radmer 1977 22 p refs
(Grant NSF AER-73-03291)
(PB-286487/4; MML-TR-77-57C; NSF/RA-770517; PR-5) Avail: NTIS HC A02/MF A01 CSCL 10A

Studies of factors causing loss of function in isolated chloroplasts were continued. The effects of linolenic acid on electron transport reactions in isolated spinach chloroplasts were investigated. A spectrophotometer was assembled to measure fast absorption changes in the U.V. and visible. Comparative studies of chloroplasts prepared from spinach leaves and bundlesheath and mesophyll tissue of corn were continued. GRA

N79-15423# Kentucky Univ., Lexington. Inst. for Mining and Minerals Research.
PROCEEDINGS OF ENERGY RESOURCE 5TH CONFERENCE
Aug. 1978 119 p refs Conf. held at Lexington, Ky., 10-11 Jan. 1978
(PB-286246/4; IMMR38-PD21-78; ISBN-0-89779-006-5) Avail: NTIS HC A06/MF A01 CSCL 10A

The most recent information available on the rapidly changing energy resource picture fuel policies, economics, and technical advances is presented. The theme of the conference was Gas from Coal for Industry: Direct Utilization of Coal Problems and Solutions. Topics covered include facilities siting, an update of energy resources, state and federal regulations, economics, coal utilization, and environmental and social considerations. GRA

N79-15424# General Accounting Office, Washington, D. C. Energy and Minerals Div.
GAO WORK INVOLVING TITLE V OF THE ENERGY POLICY AND CONSERVATION ACT OF 1975 Report to the Congress
4 Oct. 1978 18 p
(PB-286400/7; EMD-78-88) Avail: NTIS HC A02/MF A01 CSCL 10A

The results of audit work that involved Title 5 of the Energy Policy and Conservation Act of 1975 (Public Law 94-163) was summarized. The report covers the 19-month period ended July 31, 1978. GRA

N79-15425# Ecoview, Napa, Calif. National Rural Development Committee Staff.
ENERGY CONSERVATION AND THE RURAL HOME: ECONOMIC CONSIDERATIONS FOR THE NATION AND THE INDIVIDUAL
Melvin R. Janssen Jun. 1978 16 p
(PB-286222/5) Avail: NTIS HC A02/MF A01 CSCL 10A

One national goal, endorsed by the President, is to weatherize 90 percent of existing homes to minimum Federal Standards by 1985. The conservation effort in rural areas would save enough natural gas to heat over 4.3 million single-family dwellings. In addition, 54 million barrels of fuel oil would be saved. In all, energy savings in rural areas would equal 488,000 barrels of oil daily, representing 24.4 days of oil imports at 1976 import rates. If you fully retrofit an average home, you can anticipate a 35 percent reduction in fuel use. GRA

N79-15426# Massachusetts Energy Facilities Siting Council, Boston.
AN INTEGRATED REGIONAL APPROACH TO REGULATING ENERGY FACILITY SITING, PHASE 1, VOLUME 1 Final Report, 15 Sep. 1977 - 30 Jun. 1978
Aug. 1978 156 p
(Contract NRC-04-77-175)
(PB-287103/6; NUREG-CR-0241-Vol-1) Avail: NTIS HC A08/MF A01 CSCL 10B

A conceptual framework and prototype design for an integrated regional approach to regulating energy facility siting was developed from a state siting agency perspective. The foremost need was for an identification of critical long term siting issues rather than for site specific analyses. The analytical approach selected to meet the defined user needs is hierarchical. This report consists of two parts. Part I contains an introduction

to and summary of the entire project, background information and a summary of the conceptual framework, components of siting and environmental analysis, and selection of siting and environmental models and prototype design for Phase II testing. GRA

N79-15427# Massachusetts Energy Facilities Siting Council, Boston.
AN INTEGRATED REGIONAL APPROACH TO REGULATING ENERGY FACILITY SITING, PHASE 1, VOLUME 2 Final Report, 15 Sep. 1977 - 30 Jun. 1978
Aug. 1978 91 p refs
(Contract NRC-04-77-175)
(PB-287104/4; NUREG-CR-0241-Vol-2) Avail: NTIS HC A05/MF A01 CSCL 10B

A conceptual framework and prototype design for an integrated regional approach to regulating energy facility siting was developed from a state siting agency perspective. The foremost need was for an identification of critical long term siting issues rather than for site specific analyses. The analytical approach selected to meet the defined user needs is hierarchical. At the top of the hierarchy are a supply planning model and a siting model. Integration of environmental considerations is proposed through the use of generic facilities and site types and environmental criteria to constrain the supply planning model. GRA

N79-15428# Eastern Oregon Community Development Council, La Grande.
ENERGY EDUCATION TRAINING: FEASIBILITY STUDY Final Report
George R. Mead, ed. Jun. 1978 300 p refs
(Grant CSA-00757-G-77-01)
(PB-285910/6; CSA/LN-2286) Avail: NTIS HC A13/MF A01 CSCL 10A

The impact of rising energy prices on the poor and near poor was studied especially in the states of Oregon and Washington. The creation of an energy education training center is proposed to act as an agent in bringing energy conservation measures and technological innovations such as solar power to the local level. GRA

N79-15429# New Mexico Energy Inst., Albuquerque.
EFFECTIVE U VALUE: A NEW METHOD FOR PREDICTING AVERAGE ENERGY CONSUMPTION FOR HEATING BUILDINGS Final Report
Wybe J. VanderMeer and L. W. Bickle May 1978 64 p refs Prepared in cooperation with Bickle (L. W.) and Associates, Inc., Albuquerque, N. Mex.
(PB-286380/1; NMEI-76/161C) Avail: NTIS HC A04/MF A01 CSCL 10A

The effective U values in this report represent an average response to an average winter week with average temperature and solar radiation. The values are indicative of the interaction between solar radiation and thermal insulation. They represent reasonable approximations but should not be used for sizing heating equipment. They are meant only to estimate average annual energy use and compliance with prescriptive building code requirements. GRA

N79-15430# Oregon Department of Energy, Salem.
AMENDED OREGON STATE ENERGY CONSERVATION PLAN, 1978 PREPARED IN RESPONSE TO THE ENERGY POLICY AND CONSERVATION ACT OF 1975 (PL 94-163), AND THE ENERGY CONSERVATION AND PRODUCTION ACT OF 1976 (PL 94-385)
Feb. 1978 210 p refs
(PB-286078/1) Avail: NTIS HC A10/MF A01 CSCL 10A

A partial listing of contents includes: residential energy conservation program measure; building standards and lighting standards and program measure; public awareness program measure; community energy conservation program measure; education program measure; transportation program measure; comprehensive planning program measure; energy audits program measure; agriculture program measure. GRA

N79-15431# United Engineers and Constructors, Inc., Philadelphia, Pa.
COOLING SYSTEMS ADDENDUM: CAPITAL AND TOTAL GENERATING COST STUDIES
Sep. 1978 220 p refs
(Contracts AT(49-24)-0351; EY-76-C-02-2477)
(PB-287306/5; NUREG-0247; COO-2477-11) Avail: NTIS HC A10/MF A01 CSCL 10B

Design descriptions and capital cost information for three alternate cooling tower systems are presented. These cooling systems are designed for utilization with six different electric generating plants. The three cooling systems designs addressed are: once-through cooling, natural draft evaporative towers and fan-assisted natural draft evaporative towers. Impacts on the base construction cost of the electric generating plants as well as plant performance are identified for each of the alternate cooling systems. Included is a method for comparing the total generating costs for each of the six generating plants utilizing each of the cooling systems alternates. GRA

N79-15432# Utah Water Research Lab., Logan.
THE IMPACT OF ENERGY RESOURCE DEVELOPMENT ON WATER RESOURCE ALLOCATIONS
John E. Keith, K. S. Turna, Sumel Padunchai, and Rangesan Narayanan May 1978 109 p refs
(Contract DI-14-34-0001-6125; OWRT Proj. B-131-UTAH(1))
(PB-286135/9; UWRL-P-78/005; W78-11211) Avail: NTIS HC A06/MF A01 CSCL 10A

A linear programming model of the agricultural and energy sectors of Utah was used to examine the economically efficient allocation of water between agriculture and energy. Data were collected for agricultural returns, costs, and water requirements; energy returns, costs, and water requirements; and water supply costs. GRA

N79-15433# California Univ., Los Angeles.
NATURAL CONVECTION HEAT TRANSFER IN BEDS OF INDUCTIVELY HEATED PARTICLES
Seung Joon Rhee and Vijay K. Dhir Aug. 1978 99 p refs (Contract NRC-04-76-246)
(PB-287481/6; NUREG-CR-0408) Avail: NTIS HC A05/MF A01 CSCL 18I

The decay heat from the fuel debris bed of a liquid metal fast breeder reactor is removed either by conduction or convection across the superposed layer before the initiation of ebullition. Experimental observations of the onset of convective motion in such beds of inductively heated particles was made. The data for the heat transfer coefficient have been obtained in water-cooled beds of 304 stainless steel particles. The observations show that increasing the depth of the fluid layer over the bed tends to lower the critical internal Rayleigh number at which the onset of convection occurs. GRA

N79-15434# National Technical Information Service, Springfield, Va.
SOLAR SEA POWER PLANTS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Oct. 1978
Audrey S. Hundemann Nov. 1978 215 p Supersedes NTIS/PS-77/1056; NTIS/PS-76/0901
(NTIS/PS-78/1223/3; NTIS/PS-77/1056; NTIS/PS-76/0901)
Avail: NTIS HC $28.00/MF $28.00 CSCL 10B

Federally-funded research studies dealing with the technical and economic feasibility of solar sea power plants are discussed. Topic areas cover condenser, evaporator, and heat exchanger design; and, fouling and corrosion prevention. Site selection, dynamic modeling studies, and general studies dealing with solar sea power as an energy alternative are included. This updated bibliography contains 210 abstracts, 59 of which are new entries to the previous edition. GRA

N79-15435# National Technical Information Service, Springfield, Va.
SOLAR SEA POWER PLANTS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Oct. 1978
Audrey S. Hundemann Nov. 1978 128 p Supersedes NTIS/PS-77/1057; NTIS/PS-76/0902
(NTIS/PS-78/1224/1; NTIS/PS-77/1057; NTIS/PS-76/0902)
Avail: NTIS HC $28.00/MF $28.00 CSCL 10B

The present status and future prospects of using the ocean

thermal gradient for production of electric power are discussed in these citations from worldwide research. Engineering, economic, and feasibility studies are covered, including studies dealing with systems and component design. This updated bibliography contains 124 abstracts, 25 of which are new entries to the previous edition. GRA

N79-15436# National Technical Information Service, Springfield, Va.
CADMIUM SULFIDE SOLAR CELLS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Nov. 1978
Mona F. Smith Nov. 1978 266 p Supersedes NTIS/PS-77/1051; NTIS/PS-76/0929; NTIS/PS-75/693; NTIS/PS-75/089 2 Vol.
(NTIS/PS-78/1213/4; NTIS/PS-77/1051; NTIS/PS-76/0929; NTIS/PS-75/693; NTIS/PS-75/089) Avail: NTIS HC $28.00/MF $28.00 CSCL 10B

Citations from Federally-funded research cover cadmium sulfide solar cell theory, design, development, fabrication, and degradation. Studies include junctions with thin films of copper sulfide, selenides, and tellurides. The performance, testing, analysis, efficiency, and costs of these cells are covered. This updated bibliography contains 261 abstracts, 17 of which are new entries to the previous edition. GRA

N79-15437# National Technical Information Service, Springfield, Va.
CADMIUM SULFIDE SOLAR CELLS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Nov. 1978
Mona F. Smith Nov. 1978 176 p Supersedes NTIS/PS-77/1052; NTIS/PS-76/0930 2 Vol.
(NTIS/PS-78/1214/2; NTIS/PS-77/1052; NTIS/PS-76/0930) Avail: NTIS HC $28.00/MF $28.00 CSCL 10B

Worldwide research on cadmium sulfide solar cell design, development, fabrication, heterojunctions, doping, and performance are cited in this bibliography. Studies on defects, protective coatings, and arrays are included. Thin films of copper indium selenide, copper sulfide, indium phosphide, cadmium selenides, and cadmium tellurides are among those described in these photovoltaic systems. This updated bibliography contains 172 abstracts, 28 of which are new entries to the previous edition. GRA

N79-15438# Fish and Wildlife Service, Ft. Collins, Colo. Western Energy and Land Use Team.
TEXAS LIGNITE: ENVIRONMENTAL PLANNING OPPORTUNITIES
Thomas J. Cloud, Jr. Jun. 1978 19 p refs
(PB-286870/1; FWS/OBS-78/26) Avail: NTIS HC A02/MF A01 CSCL 08I

Aquatic, terrestrial, and recreational environmental impacts resulting from lignite development in Texas are reviewed. Various opportunities for proper environmental protection measures are discussed, such as involving concerned agencies and the public in planning, the establishment of reclamation plans, and the development of information regarding the environmental requirements of plant and animal species. GRA

N79-15439# Municipal Environmental Research Lab., Cincinnati, Ohio. Wastewater Research Div.
TOTAL ENERGY CONSUMPTION FOR MUNICIPAL WASTEWATER TREATMENT
Robert Smith Aug. 1978 52 p refs
(PB-286688/7; EPA-600/2-78-149) Avail: NTIS HC A04/MF A01 CSCL 10A

Quantities of all forms of energy consumed for collection, and treatment of municipal waste water were estimated. Heat energy was equated to electrical energy by a conversion factor of 10,500 Btu/kwh. Total energy consumption, expressed as kwh/mg of waste water treated, ranges from 2300-3700 kwh/mg. Energy used for construction of the treatment plant and the sewage system represented 35-55% of the total energy consumed. The remainder used for plant operation was predominately (65-75%) electrical energy. The use of high efficiency aeration devices combined with good maintenance practices appeared to offer the best opportunity for conservation of energy within the plant. GRA

N79-15440# Environmental Systems, Inc., Annapolis, Md.
USE OF SOLAR ENERGY TO HEAT ANAEROBIC DIGESTERS. PART 1: TECHNICAL AND ECONOMIC FEASIBILITY STUDY. PART 2: ECONOMIC FEASIBILITY THROUGHOUT THE UNITED STATES Feasibility Study, 5 Nov. 1975 - 1 Jun. 1976
Jess W. Malcolm and David E. Cassel Jul. 1978 99 p
(Contract EPA-68-03-2356)
(PB-286940/2; EPA-600/2-78-114-Pt-1) Avail: NTIS HC A05/MF A01 CSCL 13B

Two distinct, yet related studies were conducted to determine the technical and economic feasibility of using solar energy as the source of heat for the anaerobic digestion process. Retrofitting a solar energy collection and heat transfer system to a digester at Annapolis, Maryland was proven feasible in the first part of the study and the concept of using solar energy for digester heating throughout the United States, including Fairbanks, Alaska, was shown to be economically feasible in the second part of the study. GRA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N79-15441 National Research Council of Canada, Ottawa (Ontario). Associate Committee on Scientific Criteria for Environmental Quality.
THE AQUEOUS CHLORINATION OF ORGANIC COMPOUNDS: CHEMICAL REACTIVITY AND EFFECTS ON ENVIRONMENTAL QUALITY
Ronald C. Pierce 1978 139 p refs
(NRCC-16450; ISSN-0316-0114) Copyright. Avail: Issuing Activity

The effects on environmental quality of the release of organohalogen compounds formed during the process of aqueous chlorination are of topical concern. G.Y.

N79-15442 National Research Council of Canada, Ottawa (Ontario). Associate Committee on Scientific Criteria for Environmental Quality.
EFFECTS OF ARSENIC IN THE CANADIAN ENVIRONMENT
C. B. Furlong and J. F. Jaworski 1978 352 p refs
(NRCC-15391; ISSN-0316-0114) Copyright. Avail: Issuing Activity

Average daily environmental atmospheric arsenic levels in Yellowknife, N.W.T., ranged from 0.01 to 3.91 Microgram/cu m. Estimates of the annual rate of arsenic deposition in Yellowknife soils as a result of gold smelting operations averaged 2.2 kg/ha in 1969. A study in 1975 of the same region showed that background levels (25 ppm) in soil and soil lichens were attained only at distances greater than 80 km from the smelter complex. Arsenic concentrations in the surface soil sampled at points nearest the smelter exceeded 10.000 ppm. Snow sampled locally contained 0.0028 to 4.6 ppm arsenic. Yellowknife gold mine water ranged from 4.9 to 200 ppm arsenic while liquid seepage from tailings contained 3.7 ppm and the water in Yellowknife area lakes had less than 0.005 to 12.4 ppm. The toxicity of arsenical compounds decreases as follows: arsine (-III) greater than organo-arsine derivatives greater than arsenites (+III) greater than arsenoxides (+III) greater than arsenates (+V) greater than pentavalent organic compounds (+V) greater than arsonium metals (+I) greater than metallic arsenic (0). Inorganic arsenicals exhibit greater toxicity than organic arsenicals and the trivalent state more so than the pentavalent state. G.G.

N79-15443 National Research Council of Canada, Ottawa (Ontario). Associate Committee on Scientific Criteria for Environmental Quality.
ECOTOXICOLOGY OF CHLORPYRIFOS
W. K. Marshall, J. R. Roberts, and E. E. Kenaga (Dow Chem. Co., Midland, Mich.) 1978 318 p refs

(NRCC-16079; ISSN-0316-0114) Copyright. Avail: Issuing Activity

Chlorpyrifos, 0,0-diethyl 0-(3,5,6-trichloro-2-pyridyl) phosphorothioate, is a broad spectrum insecticide. It is known to be highly toxic to aquatic organisms. Restrictive labelling limits the potential impact of accidental or deliberate introduction of this insecticide to streams, lakes, ponds, etc. Some beneficial invertebrates and fish are affected at the rates used for mosquito control (0.014 to 0.056 kg ai/ha). The dynamics of chlorpyrifos in aquatic systems are sufficiently detailed to indicate that useful predictive correlations of residues and toxicity might be developed to interrelate the application rate with the risk of direct fish kills. There is currently not enough information available to permit adequate assessment of the long-term consequences on community recoverability and fish production. G.G.

N79-15444 National Research Council of Canada, Ottawa (Ontario). Associate Committee on Scientific Criteria for Environmental Quality.

ENVIRONMENTAL FLUORIDE 1977

Dyson Rose and John R. Marier 1977 158 p refs

(NRCC-16081; ISSN-0316-0114) Copyright. Avail: Issuing Activity

The sources and distributions of fluoride pollution and its biological and physiological effects on vegetation, animals, and humans are discussed. Topics covered include the effects of fluoride on bone content, on the components of blood and urine, and on enzymes and metabolites in soft tissues; the use of organohalides in anesthetics; mutagenic and related effects of fluorides; and the relationship between fluoride and human illness. The intake of fluoride by humans from the air and from food and beverages is assessed and criteria for preventing fluorosis are estimated. A.R.H.

N79-15445*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

LAUNCH VEHICLE EFFLUENT MEASUREMENTS DURING THE MAY 12, 1977, TITAN 3 LAUNCH AT AIR FORCE EASTERN TEST RANGE

Gerald L. Gregory, Richard J. Bendura, and David C. Woods Jan. 1979 67 p refs

(NASA-TM-78753; L-12256) Avail: NTIS HC A04/MF A01 CSCL 13B

Airborne effluent measurements and cloud physical behavior for the May 21, 1977, Titan 3 launch from the Air Force Eastern Test Range, Fla. are presented. The monitoring program included airborne effluent measurements in situ in the launch cloud, visible and infrared photography of cloud growth and physical behavior, and limited surface collection of rain samples. Airborne effluent measurements included concentrations of HCl, NO, NOx, and aerosols as a function of time in the exhaust cloud. For the first time in situ particulate mass concentration and aerosol number density were measured as a function of time and size in the size range of 0.05 to 25 micro meters diameter. Measurement results were similar to those of earlier launch monitorings. Maximum HCl and NOx concentrations ranged from 10 ppm and 500 ppb, respectively, several minutes after launch to about 1 ppm and 100 ppb at 45 minutes after launch. Author

N79-15446# Committee on Government Operations (U. S. House).

AIRCRAFT NOISE AND THE CONCORDE

Washington GPO 1978 33 p refs Rept. by the Comm. on Government Operations together with additional views, 95th Congr., 2d Sess., 9 Feb. 1978

(H-Rept-95-879; GPO-29-006; Rept-17) Avail: US Capitol House Document Room

The Concorde SST represents a serious threat to U.S. efforts to abate aircraft noise. It is extremely noisy, energy inefficient, and environmentally unsound, according to reports from FAA, EPA and GAO; yet the Federal Government has not sufficiently protected its citizens from the Concorde. The committee believes that studies by the Department of Transportation and the FAA have failed to assess adequately the problems associated with allowing the Concorde to land at U.S. airports. The recent standards proposed by the Department and the FAA for supersonic transports would not force a reduction in noise for existing Concordes. The Concorde should not be granted permanent landing rights until it is able to meet appropriate U.S. noise standards, whether expressed in terms of decibels, size of the noise contour, or vibration frequency. The committee agrees with Transportation Secretary Adams and the U.S. court of appeals that local communities have the option to make their own decision as to whether the Concorde should be permitted to land at their airport. G.Y.

N79-15447# Committee on Government Operations (U. S. House).

AIRCRAFT/AIRPORT NOISE CONTROL

Washington GPO 1977 834 p refs Hearings before a subcomm. of the Comm. on Government Operations, 95th Congr., 1st Sess., 4-5 Apr.; 20 May; 21 Jun.; 7-9 Sep. and 26 Oct. 1977

(GPO-93-187) Avail: Comm. on Government Operations

The effectiveness of the Federal program which was established to control and lessen noise pollution is reviewed with emphasis on aircraft/airport noise control. Topics covered include: noise emission standards for consumer products, railroads, and motor carriers engaged in interstate commerce; aircraft/airport noise reduction regulations; and coordination of noise research and control programs. J.M.S.

N79-15448*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

NASA GLOBAL ATMOSPHERIC SAMPLING PROGRAM (GASP) DATA REPORT FOR TAPE VL0009

J. D. Holdeman, Thomas J. Dudzinski, Ted W. Nyland, and Marvin W. Tiefermann Dec. 1978 37 p refs

(NASA-TM-79058; E-9872; Rept-8) Avail: NTIS HC A03/MF A01 CSCL 04A

The GASP atmospheric trace constituent data cover atmospheric ozone, carbon monoxide, condensation nuclei, clouds, and related meteorological and flight information obtained during October 28-31, 1977. Reported herein are flight routes and dates, instrumentation, data processing procedures, and data tape specifications. G.G.

N79-15449*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

LAUNCH VEHICLE EFFLUENT MEASUREMENTS DURING THE AUGUST 20, 1977, TITAN 3 LAUNCH AT AIR FORCE EASTERN TEST RANGE

David C. Woods, Richard J. Bendura, and Dewey E. Wornom Jan. 1979 90 p refs

(NASA-TM-78778; L-12551) Avail: NTIS HC A05/MF A01 CSCL 13B

Airborne effluent measurements within the launch cloud and visible and infrared measurements of cloud physical behavior are discussed. Airborne effluent measurements include concentrations of HCl, Cl2, NO, NOX, and particulates as a function of time during each sampling pass through the exhaust cloud. The particle size distribution was measured for each pass through the cloud. Mass concentration as a function of particle diameter was measured over the size range of 0.05- to 25 micron diameter, and particle number density was measured as a function of diameter over a size range of 0.5 to 7.5 micron. Effluent concentrations in the cloud ranged from about 30 ppm several minutes after launch to about 1 to 2 ppm at 100 minutes. Maximum Cl2 concentrations were about 40 to 55 ppb and by 20 minutes were less than 1.0 ppb. A tabulated listing of the airborne data is given in the appendix. Usable cloud imaging data were limited to the first 16 minutes after launch. A.R.H.

N79-15450*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

NASA GLOBAL ATMOSPHERIC SAMPLING PROGRAM (GASP) DATA REPORT FOR TAPES VL0010 AND VL0012

J. D. Holdeman, Thomas J. Dudzinski, Marvin W. Tiefermann, and Ted W. Nyland Jan. 1979 77 p refs

(NASA-TM-79061; E-9874) Avail: NTIS HC A05/MF A01 CSCL 13B

The GASP atmospheric trace constituent data currently available are considered. Included on tapes are in-situ measurements of atmospheric ozone, carbon monoxide, water vapor, and clouds, data from laboratory analysis of filters exposed in flight,

and related flight and meteorological data. Measurements of ozone levels within the first class cabin of these aircraft are also reported. In addition to the GASP data, tropopause pressures obtained from time and space interpolation of NMC archived data for the dates of the flights are included. Reported herein are the flight routes and dates, instrumentation, data processing procedures, data tape specifications, and analyses of the cabin ozone measurements. G.G.

N79-15451# Research Triangle Inst., Research Triangle Park, N. C.
SPECIFIC AIR POLLUTANTS FROM MUNITIONS PROCESSING AND THEIR ATMOSPHERIC BEHAVIOR. VOLUME 3: TNT PRODUCTION Final Report, Jun. 1976 - Oct. 1977
Ben H. Carpenter, Raimond Liepins, Joseph Sickles, II, Harry L. Hamilton, Douglas W. VanOsdell, George E. Weant, III, and Lesa M. Worsham Jan. 1978 139 p refs
(Contract DAMD17-76-C-6067; DA Proj. 3E7-62720-A-835) (AD-A060147; RTI/1342/00-01F-Vol-3) Avail: NTIS HC A07/MF A01 CSCL 13/2

The specific air pollutants generated from the production of RDX and TNT, together with their attendant raw material manufacture and recovery processes, and the incineration of offgrade and used materials are presented. Plant visits were made to discuss operations and acquire available data. A state-of-knowledge emissions inventory projected to mobile production rates was developed. Individual emission sources were characterized to the extent possible. The considerable data gaps were identified and flagged for further investigation. A methodology was applied to develop estimates of concentrations of the various compounds that might arise in the air over the plant. The chemical and toxicological characteristics of known emitted compounds were used and their relevant chemical reactivity under photochemical and at ground state was reviewed by literature search. The various possible transformation processes were catalogued. S.E.S.

N79-15452# Research Triangle Inst., Research Triangle Park, N. C.
SPECIFIC AIR POLLUTANTS FROM MUNITIONS PROCESSING AND THEIR ATMOSPHERIC BEHAVIOR. VOLUME 4: OPEN BURNING AND INCINERATION OF WASTE MUNITIONS Final Report, Jun. 1976 - Oct. 1977
Ben H. Carpenter, Raimond Liepins, Joseph Sickles, II, Harry L. Hamilton, Douglas W. VanOsdell, George E. Weant, III, and Lesa M. Worsham Jan. 1978 147 p refs
(Contract DAMD17-76-C-6067)
(AD-A060155; RTI/1342/00-01F) Avail: NTIS HC A07/MF A01 CSCL 13/2

This work is directed toward better definition of the specific air pollutants generated from the production of RDX and TNT, together with their attendant raw material manufacture and recovery processes, and the incineration of offgrade and used materials. Plant visits were made to discuss operations and acquire available data. These data, together with survey reports by the USAEHA and technology reports from the arsenals, were used to develop a state-of-knowledge emissions inventory projected to 'mobilization' production rates. Individual emission sources were characterized to the extent possible. The considerable data gaps were identified and flagged for further investigation. A methodology was applied to develop estimates of concentrations of the various compounds that might arise in the air over the plant. The chemical and toxicological characteristics of known emitted compounds were used and their relevant chemical reactivity under photochemical and at ground state was reviewed by literature search. The various possible transformation processes were catalogued. S.E.S.

N79-15453# Space and Missile Systems Organization, Los Angeles Air Force Station, Calif.
ENVIRONMENTAL IMPACT ANALYSIS PROCESS. ENVIRONMENTAL IMPACT STATEMENT SPACE SHUTTLE PROGRAM VANDENBERG AFB, CALIFORNIA Final Report
Jan. 1978 612 p refs
(AD-A060462) Avail: NTIS HC A99/MF A01 CSCL 22/1

The proposed action comprises construction, activation, and operation of Space Shuttle facilities at Vandenberg Air Force Base (VAFB) and Port Hueneme harbor, California. GRA

N79-15454# National Oceanic and Atmospheric Administration, Boulder, Colo. Marine Ecosystems Analysis Program Office.
REPORT ON FY 1977 NUMERICAL MODELING IN PUGET SOUND
C. S. Smyth (NOAA, Seattle) Jun. 1978 54 p refs
(PB-287820/5; NOAA-TM-ERL-MESA-30; NOAA-78092102) Avail: NTIS HC E03/MF A01 CSCL 13B

A simple single-phase pollutant trajectory model and two basic components, a method for computing surface currents, and a method for computing surface winds, were developed for the Puget Sound region. The model simulates the motion of a number of discrete floating elements under the influence of surface currents, surface winds, and parameterized diffusion. The floating elements may be introduced from several (possibly moving) sources. The computed paths of these elements approximate the paths that would be followed by a single-phase floating pollutant. The model is operational and may be accessed via voice-grade telephone lines. GRA

N79-15455# Environmental Protection Agency, Research Triangle Park, N.C. Office of Air Quality Planning and Standards.
SUPPLEMENTARY GUIDELINES FOR LEAD IMPLEMENTATION PLANS Final Report
Aug. 1978 233 p refs
(PB-286409/8; EPA-450/2-78-038; OAQPS-1.2-104) Avail: NTIS HC A11/MF A01 CSCL 13B

This guideline presents information on the development of implementation plans for lead that are not contained in EPA's regulations for preparation, adoption, and submission of implementation plans, found in Part 51 of Title 40 of the Code of Federal Regulations. In several cases, the guidance is referenced in those regulations. EPA will use this guidance in determining the acceptability of a plan. The guideline covers the following topics: general implementation plan development, reporting requirements, analysis and control strategy development, siting of urban area ambient air quality monitors for lead, new source review, and the determination of the lead point source definition. GRA

N79-15456# Carnegie-Mellon Univ., Pittsburgh, Pa.
ELECTROSTATIC EFFECTS IN FABRIC FILTRATION. VOLUME 2: TRIBOELECTRIC MEASUREMENTS AND BAG PERFORMANCE (ANNOTATED DATA) Final Report, Sep. 1973 - May 1978
E. R. Frederick Jul. 1978 81 p
(Grant EPA-R-803020)
(PB-287207/5; EPA-600/7-78-142B) Avail: NTIS HC A05/MF A01 CSCL 13K

The construction and application of a bench-scale, single-bag, experimental filter are described. Several complementary evaluation procedures and their data are reviewed. Especially significant are the methods for, and results of, electrical determinations that are not normally applied to filter media and particulates. The effect of these electrical parameters on the collection process is used to explain performance variations. Results of several filtration studies on several industrial particulates (e.g., from a power plant, and from metallurgical and chemical processes) are reviewed in detail and explained on the basis of electrostatic properties. GRA

N79-15457# Arizona Univ., Tucson. Dept. of Soils, Water and Engineering.
INVESTIGATION OF LANDFILL LEACHATE POLLUTANT ATTENUATION BY SOILS Final Report, Dec. 1972 - Jul. 1975
Wallace H. Fuller Aug. 1978 243 p refs
(Grant EPA-68-03-0208)
(PB-286995/6; EPA-600/2-78-158) Avail: NTIS HC A11/MF A01 CSCL 13B

In this laboratory study using 11 soils from 7 major orders in the U.S., the movement and retention of As, Be, Cd, CN, Cr, Cu, Hg, Ni, Pb, Se, V, and Zn when carried by municipal solid waste (MSW) leachate through soils was influenced by the individual properties of the elements, by the permeability of the soil, and by the amounts of clay, lime, and hydrous iron oxides

present in the soil. The movement of iron was also studied; its movement and retention in soil were related most strongly to the content of clay and hydrous iron oxides. Total organic carbon and chemical oxygen demand in MSW leachate were only slightly retained by soils. GRA

N79-15458# National Technical Information Service, Springfield, Va.
AIR POLLUTION CONTROL USING PARTICLE FILTRATION. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Oct. 1978
Diane M. Cavagnaro Nov. 1978 124 p Supersedes NTIS/PS-77/1017
(NTIS/PS-78/1173/0; NTIS/PS-77/1017) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 13K

The technology, equipment design and performance, ultrafiltration, and size distribution factors are discussed. Aerosol and dust filtration are included. This updated bibliography contains 119 abstracts, 20 of which are new entries to the previous edition. GRA

N79-15459# PEDCO-Environmental Specialists, Inc., Cincinnati, Ohio.
AIR POLLUTANT CONTROL TECHNIQUES FOR PHOSPHATE ROCK PROCESSING INDUSTRY Final Report
David M. Augenstein Jun. 1978 225 p
(Contract EPA-68-91-4147)
(PB-286170/6; EPA-450/3-78-030; OAQPS-1.2-113) Avail: NTIS HC A10/MF A01 CSCL 13B

Information needed by state and local pollution control agencies for development of regulations for control of particulate emissions from phosphate rock processing plants is provided. Information on process and particulate emission control equipment is included for phosphate rock dryers, calciners, grinders, and ground rock handling equipment. Cost and economic information is given for both new and retrofitted facilities, and environmental impacts are presented for different levels of emission control. Results of emission measurements performed by EPA at phosphate rock dryers, calciners, and grinders are tabulated and presented with brief descriptions of the facilities tested. EPA particulate emission test methods are also briefly described. Information presented in the document is summed up in an objective discussion of regulatory options and enforcement aspects of potential regulations. GRA

N79-15460# Oregon State Univ., Corvallis. Water Resources Research Inst.
HYDROSPHERIC TRACE ELEMENTS AND THEIR APPLICATION IN TRACING WATER POLLUTANTS Final Report
W. D. Loveland Jul. 1978 90 p refs Sponsored by the Office of Water Res. and Technol.
(PB-286114/4; WRRI-59; W78-11375; OWRT-A-043-ORE(1)) Avail: NTIS HC A05/MF A01 CSCL 13B

Principal findings are summarized of a research project to develop certain rare earth elements with short lived activation products as stable activable tracers for fluidbound pollutants in fresh waters. The rare earths are easily detected by instrumental neutron activation analysis allowing long range pollutant tracing and the use of environmentally insignificant tracer levels. The use of short-lived activation products allows rapid sample analysis and thus makes the tracers more cost competitive. GRA

N79-15461# NATO Committee on the Challenges of Modern Society, Brussels (Belgium).
INLAND WATER POLLUTION FOLLOW-UP REPORT
Apr. 1978 18 p
(PB-286116/9; NATO/CCMS-79) Avail: NTIS HC A02/MF A01 CSCL 13B

In October 1974 the pilot study of the NATO/CCMS was completed with the publication of 'Inland Water Pollution', NATO/CCMS Report 36. Canada was the pilot country for the study and Belgium, France and the United States acted as co-pilots. The study had two main goals: (1) to demonstrate ways in which countries can cooperate in reducing water pollution to their mutual benefit, and (2) to develop improved techniques and concepts for water quality management that would be of broad interest to member countries in dealing with internal and international problems of freshwater pollution. To assess the study effectiveness, this post-evaluation was carried out. This report represents the results of a member country poll, centered around the original study recommendations, regarding measures which countries have taken to manage the quality of their inland waters. GRA

N79-15462# Environmental Protection Agency, Research Triangle Park, N.C. Office of Air Quality Planning and Standards.
CONTROL OF VOLATILE ORGANIC COMPOUND LEAKS FROM PETROLEUM REFINERY EQUIPMENT
K. C. Hustvedt, R. A. Quaney, and W. E. Kelly Jun. 1978 72 p refs
(PB-286158/1; EPA-450/2-78-036; OAQPS-1.2-111) Avail: NTIS HC A04/MF A01 CSCL 13B

The necessary guidance for development of regulations to limit emissions of volatile organic compounds (VOC) from petroleum refinery equipment leaks is provided. Equipment considered includes pump seals, compressor seals, seal oil degassing vents, pipeline valves, flanges and other connections, pressure relief devices, process drains, and open ended pipes. Reasonably available control technology (RACT) for these sources consists of a routine monitoring schedule to locate leaks so that maintenance can be performed as possible and emissions of VOC to atmosphere reduced. An example cost analysis for implementing these controls in a model refinery is presented along with a methodology for evaluating the cost effectiveness of these controls when updated emission factors become available. GRA

N79-15463# Colorado Univ., Boulder. Dept. of Economics.
COMPARATIVE ANALYSIS AND CRITIQUE OF THE INSTITUTIONAL FRAMEWORK FOR WATER RESOURCES PLANNING AND MANAGEMENT: CANADA, UNITED STATES, AND MEXICO Final Report
Charles W. Howe Oct. 1977 105 p refs Sponsored by Office of Water Research and Technology, Wash., D. C.
(PB-286108/6; W78-11382) Avail: NTIS HC A06/MF A01 CSCL 13B

An analytical scheme is established for assisting in the design and evaluation of a country's water planning and management institutions. The framework consists of (1) a taxonomy of the major components of the institutional framework and (2) an evaluation procedure based on performance criteria and design characteristics. The institutional frameworks for Canada, the United States, and Mexico are described, including the relevant international institutions. An assessment of these three countries is then made. GRA

N79-15464# Environmental Protection Agency, Research Triangle Park, N.C. Office of Air Quality Planning and Standards.
ELECTRIC UTILITY STEAM GENERATING UNITS: BACKGROUND INFORMATION FOR PROPOSED NOx EMISSION STANDARDS
Jul. 1978 226 p refs
(PB-286155/7; EPA-450/2-78-005A) Avail: NTIS HC A11/MF A01 CSCL 13B

Revised Standards of Performance for the control of emissions of nitrogen oxides from electric utility power plants are being proposed under the authority of section 111 of the Clean Air Act. These standards would apply only to electric utility steam generating units capable of combusting more than 73 MW heat input (250 million Btu) of fossil fuel and for which construction or modification began on or after the date or proposal of the regulations. This document contains background information, environmental and economic impact assessments, and the rationale for the standards. GRA

N79-15465# Environmental Protection Agency, Research Triangle Park, N.C. Office of Air Quality Planning and Standards.
ELECTRIC UTILITY STEAM GENERATING UNITS: BACKGROUND INFORMATION FOR PROPOSED SO2 EMISSION STANDARDS
Aug. 1978 107 p
(PB-286159/9; EPA-450/2-78-007A-1) Avail: NTIS HC A06/MF A01 CSCL 13B

Revised Standards of Performance for the control of sulfur dioxide emissions from electric utility power plants are being proposed under the authority of section 111 of the Clean Air Act. This document contains background information, environmental and economic impact assessments, and the rationale for the standards, as proposed under 40 CFR Part 60, Subpart Da.GRA

N79-15466# National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Labs.
ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. PROGRAM WORK STATEMENTS, FY 1978, VOLUME 1
Jun. 1978 755 p ref Sponsored in part by Bureau of Land Management, Washington, D. C. 3 Vol.
(PB-287812/2; NOAA-78081601-Vol-1) Avail: NTIS HC A99/MF A01; also available in set of 3 reports HC E20 as PB-287811-SET CSCL 08A

Aquatic life or non-living resources likely to be involved in one way or another by resources development on the Alaskan Continental Shelf were surveyed. The specific life forms, geology, ice transport, hazards and ecology in this cold region were studied. GRA

N79-15467# National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Labs.
ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. PROGRAM WORK STATEMENTS, FY 1978, VOLUME 2
Jun. 1978 653 p ref Sponsored in part by Bureau of Land Management, Washington, D. C. 3 Vol.
(PB-287813/0; NOAA-78081602-Vol-2) Avail: NTIS HC A99/MF A01; also available in set of 3 reports HC E20 as PB-287811-SET CSCL 08A

Aquatic life or non-living resources likely to be involved in one way or another by resources development on the Alaskan Continental Shelf are surveyed. The specific life forms, geology, ice transport, hazards and ecology in this cold region were studied. GRA

N79-15468# National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Labs.
ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. PROGRAM WORK STATEMENTS, FY 1978, VOLUME 3
Jun. 1978 847 p ref Sponsored in part by Bureau of Land Management, Washington, D. C. 3 Vol.
(PB-287814/8; NOAA-78081603-Vol-3) Avail: NTIS HC A99/MF A01; also available in set of 3 reports HC E20 as PB-287811-SET CSCL 08A

Aquatic life of non-living resources likely to be involved in one way or another by resources development on the Alaska Continental Shelf were surveyed. The specific life forms, geology, ice transport, hazard and ecology in this cold region were studied. GRA

N79-15469# Calspan Corp., Buffalo, N. Y.
SYSTEM FOR APPLYING POWDERED GELLING AGENTS TO SPILLED HAZARDOUS MATERIALS
J. G. Michalovic, C. K. Akers, R. W. King, and R. J. Pilie Jul. 1978 31 p refs
(Contract EPA-68-03-2093)
(PB-286308/2; EPA-600/2-78-145) Avail: NTIS HC A03/MF A01 CSCL 13B

A blended material that would optimally immobilize a wide range of liquid chemicals detrimental to the environment was developed. The product of this research was Multipurpose Gelling Agency (MGA), a blend of four polymers and an inorganic powder. When MGA was applied to a chemical spill, it turns the hazardous liquid into a gelatinous mass which can be easily removed by shovel or other mechanical means. The MGA research program has also included design, fabrication, testing, and demonstration of a mobile, self-powered, mechanical system for dispensing powdered MGA to spill target areas in a safe and effective manner. A prototype of the Mobile Dispensing System (MDS) was constructed and tested. The MDS unit was tested against both small and large scale simulated spills. GRA

N79-15470# University of Southern Calif., Los Angeles.
THE USE OF CARBON AND SULFUR ISOTOPIC RATIOS AND TOTAL SULFUR CONTENT FOR IDENTIFYING THE ORIGIN OF BEACH TARS IN SANTA MONICA BAY, CALIFORNIA M.S. Thesis
Blayne Alan Hartman Jun. 1978 113 p refs
(Grant NOAA-04-6-158-4418)
(PB-286780/2; USC/SG/TD-02-78) Avail: NTIS HC A06/MF A01 CSCL 07D

Carbon and sulfur isotopic ratios and total sulfur content are evaluated as chemical fingerprints for highly weathered petroleum in the marine environment. Analysis is confined strictly to the asphaltene fraction of petroleum owing to the insensitivity of the fraction to weathering processes. The technique is applied to the problem of the source identification of tar depositing on the coastline adjacent to metropolitan Los Angeles, California. Comparison of the same parameters from beach tars collected during the 1976-1977 years to the parameters of the potential source oil suggests that 51% of the tars in Santa Monica Bay are derived from natural oil seepage at Coal Oil Point, 31% from natural oil seepage in Santa Monica Bay, and 18% from unknown sources. The chemical data, coupled with seasonal monitoring of tar deposition and slick size at oil seeps, allow models of tar transport to be deduced. GRA

N79-15471# Butler Univ., Indianapolis, Ind. Holcombe Research Inst.
UTILIZATION OF NUMERICAL GROUNDWATER MODELS FOR WATER RESOURCE MANAGEMENT Final Report, Jun. 1975 - Sep. 1977
Yehuda Bachmat, Barbara Andrews, David Holtz, and Scott Sebastian Jun. 1978 189 p ref Sponsored in part by Sci. Comm. on Probl. of the Environment
(Grant EPA-R-803713)
(PB-285782/9; EPA-600/8-78-012) Avail: NTIS HC A09/MF A01 CSCL 13B

The present status of international numerical models, as a tool for groundwater related water resource management was assessed. Among the problem areas considered are: The accessibility of models to users; communications between managers and technical personnel; inadequacies of data; and inadequacies in modeling. The models are categorized as prediction, management, identification, and data management models. GRA

N79-15472# Association of Environmental Engineering Professors, Blacksburg, Va.
FUNDAMENTAL RESEARCH NEEDS FOR WATER AND WASTEWATER TREATMENT SYSTEMS
J. H. Sherrard 1978 108 p refs Conf. held at Arlington, Va., 15 Dec. 1977 Sponsored by NSF
(PB-286136/7; NSF/RA-780234) Avail: NTIS HC A06/MF A01 CSCL 13B

The conference was organized to direct the attention of those in government, in academia, and in the private sector to the need for increased efforts in long-term fundamental research on water and wastewater treatment systems, in order to reverse the trend toward short-term immediate application research. The conference objectives were: (1) To provide a forum and focal point for the exchange of information on fundamental research needs between the academic community, users of research, and granting agencies; (2) to define and establish priorities for these research needs; (3) to disseminate the conference proceedings for the purpose of stimulating research in high priority areas; and (4) to discuss methods designed to improve the quality of the nation's water resources. GRA

N79-15473# Environmental Monitoring and Support Lab., Cincinnati, Ohio.
ANALYSIS OF RADIOACTIVE CONTAMINANTS IN BY-PRODUCTS FROM COAL-FIRED POWER PLANT OPERATIONS
Herman Krieger and Betty Jacobs Jul. 1978 41 p refs
(PB-286365/2; EPA-600/4-78-039) Avail: NTIS HC A03/MF A01 CSCL 18H

The major radionuclides detected in fossil fuel power plant operations were identified and quantified. Samples of coal, flyash, bottom ash, and scrubber sludge were collected from different

regions in the U.S. and analyzed for radium, thorium, and uranium. The report tabulates the spectrum of activity levels in a variety of samples, and compares the results from nondestructive spectrometry and from radiochemical separations. The environmental impact of an expanding fossil-fuel power plant operation is discussed, and it is concluded that, for the present, no radiation hazard exists. GRA

N79-15474# Massachusetts Inst. of Tech., Cambridge. Dept. of Chemical Engineering.
COMBUSTION RESEARCH ON THE FATE OF FUEL-NITROGEN UNDER CONDITIONS OF PULVERIZED COAL COMBUSTION Final Task Report
J. M. Levy, J. H. Pohl, A. F. Sarofim, and Y. H. Song Aug. 1978 187 p refs
(Grant EPA-R-803242)
(PB-286208/4; EPA-600/7-78-165) Avail: NTIS HC A09/MF A01 CSCL 21B

Coal pyrolysis and oxidation, and char oxidation were studied to determine the effects of temperature and fuel/oxygen equivalence ratio on the conversion of coal-nitrogen to NOx. The devolatilization experiments showed that no nitrogen loss occurred until 10 to 15% of the coal had been devolatilized. Nitrogen was completely removed from the char by prolonged heating at above 1750 K. Loss of nitrogen and total weight loss are linearly correlated with a nitrogen-to-carbon slope of 1.25 to 1.5. Volatile nitrogen compounds accounted for the major fraction of NOx produced from coal-nitrogen. The results suggest that low NOx emissions from pulverized coal combustion are favored by a two-stage design: the first stage operated fuel-rich at high temperature; the second, fuel-lean at low temperature. GRA

N79-15475# GCA Corp., Bedford, Mass. Technology Div.
EVALUATION OF MOTOR VEHICLE EMISSIONS INSPECTION AND MAINTENANCE PROGRAMS IN OHIO, PHASE 2 Final Report
David B. Ramsay, Lee A. Coda, Robert O. Phillips, Nancy K. Roy, and Frederick M. Sellars Aug. 1978 351 p refs
(Contract EPA-68-02-2607)
(PB-286209/2; GCA-TR-38-G(1); EPA-905/2-78-006) Avail: NTIS HC A16/MF A01 CSCL 13F

The state must, among other things, have adopted a firm schedule for implementing a motor vehicle inspection and maintenance (I/M) program in the highly urbanized nonattainment areas. In this connection, the state of Ohio is currently in the initial stages of planning for the implementation of an I/M program. As part of this initial effort, several candidate program configurations were analyzed from the standpoint of costs, benefits, and other requirements. These analyses, which are reported herein, will provide the basis for the state to select one specific option that will eventually be implemented. GRA

N79-15476# Rutgers - The State Univ., New Brunswick, N. J. Center for Coastal and Environmental Studies.
MICROBIAL CONTRIBUTIONS TO NUTRIENT CYCLING IN THE NEW YORK BIGHT Final Report, 1 Feb. 1976 - Jan. 1977
Carol D. Litchfield Aug. 1978 116 p refs
(Grant NOAA-04-6-022-044020)
(PB-287661/3; NOAA-78083005) Avail: NTIS HC A06/MF A01 CSCL 13B

The following studies are combined to form this final report: Impact of a Ceratium bloom on microbial biomass and activities in sediments of the New York Bight; Adenosine triphosphate in sediments of the New York Bight; and the effect of cadmium and petrochemicals on sedimentary microorganisms in the New York Bight. GRA

N79-15477# Research Triangle Inst., Research Triangle Park, N. C.
OPTIMUM METEOROLOGICAL AND AIR POLLUTION SAMPLING NETWORK SELECTION IN CITIES. VOLUME 1: THEORY AND DESIGN FOR ST. LOUIS
Fred M. Vukovich, Walter D. Bach, Jr., and C. Andrew Clayton Jun. 1978 154 p refs
(Contract EPA-68-03-2187)
(PB-285484/2; EPA-600/4-78-030) Avail: NTIS HC A08/MF A01 CSCL 04A

A technique was developed to establish an optimum meteorological and air pollution sampling network in urban areas. The basis of the network is the wind field in the urban area rather than the air pollution distribution. Three specific models are required in order to determine the optimum network. These are: a three dimensional hydrodynamic model; a statistical model; and an objective variational analysis model. Simulated data were used to determine the form of a regression model which approximates the various wind fields and derives the sampling network for the winds. The air pollution distribution is obtained through an objective variational analysis model. GRA

N79-15478# Radian Corp., Austin, Tex.
CHARACTERIZATION OF CARBIDE LIME TO IDENTIFY SULFITE OXIDATION INHIBITORS Final Report, Sep. 1977 - Jul. 1978
L. J. Holcombe and K. W. Luke Sep. 1978 79 p refs
(Contract EPA-68-02-2608)
(PB-286646/5; EPA-600/7-78-176) Avail: NTIS HC A05/MF A01 CSCL 07D

Results of a study of carbide lime--a by-product of acetylene manufacture, primarily calcium hydroxide--used in a flue gas desulfurization (FGD) system at Louisville Gas and Electric (LGE) are provided. The study was undertaken to: identify sulfite ion oxidation inhibitors in carbide lime and develop an analytical method for sulfite that avoids the interferences observed in analyzing scrubber liquors from LGE's FGD system. Thiosulfate was identified as the oxidation inhibitor in carbide lime; it was also identified (along with other reduced sulfur species) as a source of interference in the iodine titration method used at LGE for sulfite analysis. GRA

N79-15479# Radian Corp., Austin, Tex.
GUIDELINES FOR PREPARING ENVIRONMENTAL TEST PLANS FOR COAL GASIFICATION PLANTS Final Report, May 1976 - Dec. 1977
G. C. Page, W. E. Corbett, and W. C. Thomas Jul. 1978 187 p refs
(Contract EPA-68-02-2147)
(PB-286659/8; EPA-600/7-78-134) Avail: NTIS HC A09/MF A01 CSCL 07D

A philosophy and strategy for preparing environmental assessment sampling and analysis (test) plans are outlined. Five major points of test plan development are addressed: (1) defining the test objectives, (2) performing an engineering analysis of the test site, (3) developing a sampling strategy, (4) selecting analytical methods, and (5) defining data management procedures. The important considerations involved in each area are discussed in relation to three types of environmental tests: (1) waste stream (levels 1, 2, and 3), (2) control equipment, and (3) process stream characterization. Specific sampling and analytical methods are presented, with numerous references cited for more detailed information. GRA

N79-15480# Georgia Univ., Athens. Dept. of Chemistry.
SURFACTANT EFFECTS ON PESTICIDE PHOTOCHEMISTRY IN WATER AND SOIL Final Report, Apr. 1974 - Nov. 1977
Richard R. Hautala Jun. 1978 83 p refs
(Contract EPA-R-802959)
(PB-285175/6; EPA-600/3-78-060) Avail: NTIS HC A05/MF A01 CSCL 07D

The effects of surfactants on the photochemical decomposition of selected pesticides are examined both in aqueous solution and on selected soil surfaces. Typical surfactants usually enhance the rate of pesticide photodecomposition. In solution, increased quantum efficiencies and increased overlap with available solar irradiation are observed. In addition, surfactants enhance the solubility of otherwise sparingly soluble pesticides. Photodecomposition on soil surfaces is inefficient. Surfactants enhance the rates of decomposition in certain cases on soil surfaces, but the effects do not appear to be sufficiently large to make such a mode of decomposition competitive. GRA

N79-15481# Research Triangle Inst., Research Triangle Park, N. C.
COMPUTER ASSISTED AREA SOURCE EMISSIONS

(CAASE) GRIDDING PROCEDURE (REVISED). IBM 370/OS VERSION USER'S MANUAL Final Report
Richard C. Haws and J. W. Dunn, III Mar. 1978 468 p
(Contract EPA-68-02-2501)
(PB-286285/2; EPA-450/3-78-009) Avail: NTIS
HC A20/MF A01 CSCL 13B

Atmospheric dispersion modeling programs such as the Climatological Dispersion Model (CDM), Air Quality Display Model (AQDM), and implementation Planning Program (IPP) are among the most basic tools used for evaluation of air quality and State Implementation Plans (SIP's). Since emissions data comprise the most important input information for these models, any factor affecting the availability and completeness of the emissions data has a significant impact on the results of the modeling programs. Procedures for formating emissions from point sources are well defined; however, area source emission data present problems. Usually the smallest geographic unit for which accurate primary data are available is the county. These data must be disaggregated and appropriately allocated to smaller areas to provide an adequately detailed input. The five major computer gridding programs and associated subroutines contained in this revised manual provide an objective method for allocating county-level data to grid squares selected on the basis of demographic features and sized to give appropriate detail for input to air quality modeling programs. GRA

N79-15482# Chesapeake Research Consortium, Inc., Annapolis, Md.
CHESAPEAKE BAY BASELINE DATA ACQUISITION, TOXICS IN THE CHESAPEAKE BAY Final Preliminary Report, 1946-1978
Jul. 1978 277 p refs
(Contract EPA-68-01-3994)
(PB-286947/7; EPA-903/9-78-017) Avail: NTIS
HC A13/MF A01 CSCL 06F

Researchers, research activities, and data files applicable to the Chesapeake Bay estuarine system are identified. The identified data were generated after 1973 on the following: submerged aquatic vegetation, shellfish bed closures, eutrophication, toxics accumulation in the food chain, dredging and spoil disposal, hydrologic modifications, modification of fisheries, shoreline erosion, wetlands alterations, and the effects of boating and shipping on water quality. Major past and current program monitoring in the Bay and its tributaries are summarized according to frequency. GRA

N79-15483# Burgess and Niple Ltd., Columbus, Ohio.
FULL SCALE DEMONSTRATION OF LIME STABILIZATION Final Report
Richard F. Noland, James D. Edwards, and Mark Kipp Sep. 1978 91 p refs
(Contract EPA-68-03-2181)
(PB-286937/8; EPA-600/2-78-171) Avail: NTIS
HC A05/MF A01 CSCL 13B

The feasibility, economics, and benefits of stabilizing primary, waste activated, septic, and anaerobically digested sludges by lime addition are considered. The project confirmed the findings of previous laboratory and pilot scale tests and focused on the application of lime stabilization and land disposal techniques to a wastewater treatment plant operating in the range of 3,785 to 5,675 cu m/day (1.0 to 1.5 MGD). Emphasis was placed on the chemical, bacterial, and pathological properties of raw, lime stabilized and anaerobically digested sludges. The effects of long-term storage on the chemical and bacterial characteristics of lime stabilized sludges were determined. GRA

N79-15484# Municipal Environmental Research Lab., Cincinnati, Ohio. Wastewater Research Div.
BIODEGRADATION STUDIES OF CARBOXYMETHYL TARTRONATE Final Report, Jun. 1976 - May 1978
E. F. Barth, H. H. Tabak, and C. I. Mashni Jul. 1978 46 p refs
(PB-286970/9; EPA-600/2-78-115) Avail: NTIS
HC A03/MF A01 CSCL 13B

Carboxymethyl tartronate (CMT) was shown to be biodegradable in bench-scale activated sludge reactors. After initial exposure to CMT in continuous flow systems an acclimation period of 14 weeks was necessary before efficient degradation occurred. Once acclimated to CMT the biomass could be starved in regard to this substrate for at least 1.6 times the sludge age and still retain capacity to degrade the material upon re-introduction. Activated carbon was not found to be effective for CMT removal at a pH value of 7. GRA

N79-15485# Martin (A. W.), Inc., King of Prussia, Pa.
GUIDANCE MANUAL FOR MINIMIZING POLLUTION FROM WASTE DISPOSAL SITES Final Report
Andrew L. Tolman, Antonio P. Ballestero, Jr., William W. Beck, Jr., and Grover H. Emrich Aug. 1978 95 p refs
(Contract EPA-68-03-2519)
(PB-286905/5; EPA-600/2-78-142) Avail: NTIS
HC A05/MF A01 CSCL 13B

This manual provides guidance in the selection of available engineering technology to reduce or eliminate leachate generation at existing dumps and landfills. The manual emphasizes remedial measures for use during or after closure of landfills and dumps which do not meet current environmental standards. Most of the techniques deal with the reduction or elimination of infiltration into landfills in one of five categories: active groundwater or plume management, chemical immobilization of waste, and excavation and reburial. The technology is widely used in construction but has not necessarily as yet been applied to landfill closure. GRA

N79-15486# Logistics Management Inst., Washington, D. C.
THE ECONOMIC IMPACT OF REVISED GASEOUS EMISSION REGULATIONS FOR COMMERCIAL AIRCRAFT ENGINES
C. F. Day and H. E. Bertrand Jan. 1978 128 p
(Contract EPA-68-01-4647)
(PB-286772/9) Avail: NTIS HC A07/MF A01 CSCL 13B

The EPA has proposed the revision of the gaseous emission regulations first promulgated in 1973 (40 CFR Part 87) for several classes of aircraft engines. A draft notice of proposed rule making was prepared and circulated informally outside EPA in the late summer of 1977. The results of an economic impact analysis of the proposed standards are presented as they apply to commercial aircraft engines. GRA

N79-15487# Environmental Protection Agency, Corvallis, Oreg.
A COMPENDIUM OF LAKE AND RESERVOIR DATA COLLECTED BY THE NATIONAL EUTROPHICATION SURVEY IN THE WESTERN UNITED STATES Working Paper Series
Sep. 1978 171 p
(PB-286826/3; Working-Paper-477) Avail: NTIS
HC A08/MF A01 CSCL 13B

Morphometric, limnological, and nutrient loading data are summarized for 153 lakes and reservoirs studied during 1974-1975. The water bodies for which data are summarized are located in the states of Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming. GRA

N79-15488# Marder and Associates, Springfield, Ill.
AN ECONOMIC IMPACT STUDY OF PARTICULATE EMISSION STANDARDS FOR COMBUSTION OF LOW CARBON WASTES (R77-5) Final Report
Sidney M. Marder Jun. 1978 106 p refs Sponsored by Ill. Inst. of Nat. Resources.
(PB-286872/7; IIEQ-78-06) Avail: NTIS HC A06/MF A01 CSCL 13B

Particulate emission standards for the incineration of low carbon wastes are discussed. The cost and benefits of the proposed regulation R77-5 and its areas of application are emphasized. GRA

N79-15489# Environmental Protection Agency, Research Triangle Park, N.C. Monitoring and Data Analysis Div.
AN APPROACH FOR THE PRELIMINARY ASSESSMENT OF TSP CONCENTRATIONS
Thomas G. Pace Jul. 1978 78 p refs
(PB-286201/9; EPA-450/2-78-016) Avail: NTIS
HC A05/MF A01 CSCL 13B

Air quality data for total suspended particulate (TSP) in 13 U.S. urban areas was examined. The data from 142 monitoring

sites were grouped so that residential and commercial sites in non- or light-industrial urban areas could be examined. A relationship between height and concentration was noted at the sites with nearby ground-level activity due to traffic, parking, etc., such that the concentration decreased exponentially with increasing height of the monitor above ground. No such relationship was found at sites with no ground-level activity. Commercial and industrial sites were found to be near ground-level activity in 90 percent of the cases examined while residential sites were virtually never located near such activity. GRA

N79-15490# Rhode Island Univ., Kingston. Dept. of Civil and Environmental Engineering.
WATER POLLUTION CONTROL IN METAL FINISHING INDUSTRY Completion Report, 1 Jul. 1976 - 30 Jun. 1978
Calvin P. C. Poon 30 Jun. 1978 16 p refs Sponsored by Office of Water Res. and Technol.
(PB-286089/8; W78-11380; OWRT-A-062-R(1)) Avail: NTIS HC A02/MF A01 CSCL 13B

A unique electrochemical reactor was used for batch treatment of metal finishing waste water. Using low dc currents, waste water containing copper, nickel or zinc, or cadmium with cyanide, and chromium could be removed successfully to meet the federal effluent quality standards. Electrocoagulation and flotation, as well as chlorination, were responsible for all the reactions required in the removal processes. Sacrificing iron anode was used for the chromium removal process while a plantinated anode was used for others. Performance models and a cost analysis were presented. Use of lower electric currents often resulted in a higher metal removal potential expressed as mg metal removal per kwh power consumption. GRA

N79-15491# Rutgers - The State Univ., New Brunswick, N. J.
ESTIMATING RUNOFF POLLUTION FROM LARGE URBAN AREAS - THE DELAWARE ESTUARY Final Report
William Whipple, Jr., Joseph V. Hunter, Robert C. Ahlert, and Shaw L. Yu Jul. 1978 80 p refs
(Grants DI-14-34-0001-5128; DI-14-34-0001-7124; OWRT Proj. B-059-NJ)
(PB-286719/0; W78-12111) Avail: NTIS HC A05/MF A01 CSCL 13B

Research conducted on methods of estimating nonpoint source pollution from large areas is reported. Analyses of the BOD reaction indicate no serious inadequacies, in this case, of the usual approaches based on first order decay estimated from BOD rate determinations. Existing modeling methodologies were analyzed, and suggestions made for improved approaches. Subsequent quantitative analysis was made on the basis of storm event loading determinations, related statistically to storm characteristics and to land use. Considerable data, obtained in the Trenton and Philadelphia areas, are compared and extended to the urban areas adjacent to the Delaware Estuary. GRA

N79-15492# Louisiana State Univ. and A&M Coll., Baton Rouge. Agricultural Experiment Station.
WATER QUALITY RENOVATION OF ANIMAL WASTE LAGOONS UTILIZING AQUATIC PLANTS Final Report, Jul. 1975 - Dec. 1977
Dudley D. Culley, Jr., James H. Gholson, Tom S. Chisholm, Leon C. Standifer, and Tom S. Epps Jul. 1978 167 p refs
(Grant EPA-R-803326)
(PB-286938/6; EPA-600/2-78-153) Avail: NTIS HC A08/MF A01 CSCL 13B

Duckweeds Spirodela oligorhiza, S. polyrhiza, and Lemna gibba (clone G3) grown on dairy waste lagoons gave an estimated maximum annual yield of 22,023 kg dry wt./ha. S. oligorhiza and L. gibba had higher growth rates in the spring, fall, and winter, with L. gibba growing throughout most of the winter. Nutrient content of the plants increased with increasing nutrients in the lagoons. Mean crude protein of dry duckweeds was 36%, to a maximum of 42%. The duckweeds recovered on a hectare basis the N, P, and K of 15.5, 34, and 8.8 lactating cows respectively. GRA

N79-15493# Technology Service Corp., Santa Monica, Calif.
VISIBILITY IN THE NORTHEAST: LONG-TERM VISIBILITY TRENDS AND VISIBILITY/POLLUTANT RELATIONSHIPS Interim Report, Oct. 1977 - Apr. 1978
R. B. Husar (Washington Univ., St. Louis, Mo.), John Trijonis, and Kung Yuan Aug. 1978 96 p refs
(Grant EPA-803896)
(PB-286921/2; EPA-600/3-78-075) Avail: NTIS HC A05/MF A01 CSCL 13B

The historical data base pertinent to visibility in the Northeast is analyzed. The data base includes approximately 25 years of airport visibility observations and more than 10 years of NASN particulate measurements. Visibility levels, long-term trends in visibility, and visibility/pollutant relationships are covered. Visibility in the Northeast is rather poor, median visual range being on the order of 10 miles. Visual range declined remarkably during the third calendar quarter relative to other seasons, making the summer now the worst season for visibility. Regression models based on daily variations in visibility and pollutant concentrations indicate that sulfate aerosol is the single major contributor to haze in the Northeast. GRA

N79-15494# California Univ., Berkeley. Sea Water Conversion Lab.
MOLECULAR BACKWASH FOR DECONTAMINATION AND REJUVENATION OF MEMBRANES Final Report, 1 Apr. 1977 - 31 Mar. 1978
K. S. Spegler Aug. 1978 32 p refs
(Contract DI-14-34-0001-7536)
(PB-286720/8; W78-12101) Avail: NTIS HC A03/MF A01 CSCL 07D

In studies of osmotic and electroosmotic backwash to decontaminate hyperfiltration membranes, it was found that the direction and magnitude of electroosmotic flow in asymmetric cellulose acetate membranes in sodium chloride solutions depends on the concentration of the solutions contacting the membrane. Conclusions from electrochemical evidence indicate that if the solution concentrations are below 0.02 M NaCl, the membranes (cured at 91.5-94C) are cation selective and above 0.1 M NaCl the membranes are anion selective. It is shown that the friction model of mass transport across membranes can explain reversal of electroosmotic flow, and of membrane selectivity even in homogeneous membranes. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N79-15495* National Aeronautics and Space Administration, Washington, D. C.
SAGE TO EXAMINE EARTH'S STRATOSPHERE
18 Jan. 1979 21 p
(NASA-News-Release-79-6; P79-10006) Avail: NASA Scientific and Technical Information Facility, P. O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 04A

The SAGE mission is discussed along with the role of the Nimbus 7 experiment. Other topics discussed include: ground truth measurements, data collection and processing, SAGE instrumentation, and launch sequence. F.O.S.

N79-15496*# Lunar and Planetary Inst., Houston, Tex.
SCANNING ELECTRON MICROSCOPY AND PETROGRAPHY OF GLASSY PARTICLES PRODUCED BY LAVA FOUNTAIN ERUPTIONS Ph.D. Thesis - Brigham Young Univ. Final Report
Garth H. Ladle 1978 222 p refs
(Contract NAS9-14499)
(NASA-CR-157865) Avail: NTIS HC A10/MF A01 CSCL 08K

Glassy particles produced by lava fountain eruptions consist primarily of sideromelane glass and minor to moderate amounts of vesicles and crystals. The internal texture and surficial microstratigraphy of a glassy particle indicates its formation history, the capture and accumulation of other particles, the possible loss or removal of material by fracturing or abrasion, and its decomposition or alteration by solution, oxidation or hydration. After initial formation, a particle constructively accumulates other

solid or liquid materials by accretion or sublimation and condensation or vapor phase crystals, micromounds and condensed liquids. Terrestrial and lunar glassy particles have generally similar abundances of particle types, internal texture and surficial features. Notable differences are the dearth of glassy filaments and elongate particles in lunar soils and the paucity of agglutinates in terrestrial pumice deposits. L.S.

N79-15497# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
ATMOSPHERIC MEASUREMENTS NEAR 118 GHz WITH PASSIVE MICROWAVE TECHNIQUES Final Report, 1 Feb. 1975 - 31 Dec. 1977
David H. Staelin, Philip W. Rosenkranz, Alan Cassel, David McDonough, and Paul Steffes Jun. 1978 69 p refs
(Contract F19628-75-C-0122)
(AD-A060303; AFGL-TR-78-0183) Avail: NTIS HC A04/MF A01 CSCL 04/2

This report describes the results of ground-based passive spectral observations of the atmosphere near 60 and 118 GHz, aircraft based 118 GHz spectral observations of the atmosphere, and theoretical evaluation of the ability of a 118 GHz passive microwave spectrometer, alone and in combination with other microwave spectrometers, to yield linear retrievals of atmospheric humidity, cloud profiles, and temperature profiles. The observed 118 GHz absorption profile was close to that expected, and the theoretical studies showed that a 118 GHz spectrometer can perform approximately as well as one at 60 GHz, although the cloud sensitivity is slightly greater. GRA

N79-15498# Naval Surface Weapons Center, Dahlgren, Va.
DETERMINATION OF PLATE TECTONIC MOTION FROM DOPPLER OBSERVATIONS OF NAVY NAVIGATION SATELLITES Final Report
R. J. Anderle Aug. 1978 65 p refs
(AD-A060901; NSWC/DL-TR-3884) Avail: NTIS HC A04/MF A01 CSCL 08/5

Doppler observations of Navy Navigation Satellites have yielded precisions in the determination of rates of change of station position of 2 cm/yr, based on data sampled over a 14-yr period, and 3 cm/yr for nearly continuous data over a 6-yr period. The accuracy of the determination is better than 10 cm/yr in horizontal position and 15 cm/yr in height for either data span. A number of changes in data acquisition and data reduction are proposed which will improve the accuracy of the results and lead to the determination of plate tectonic motion from this data. The computed latitude rate for Australia, which is 12.1 + or - 1.5 cm/yr, is consistent with geologic estimates. Maintenance of the base station network is critical to obtaining such results for other components of station position, other geographic areas, and other time periods. Author (GRA)

N79-15499# Rome Air Development Center, Griffiss AFB, N.Y.
VLF/LF REFLECTIVITY OF THE POLAR IONOSPHERE, 4 SEPTEMBER - 31 DECEMBER 1977
Robert P. Pagliarulo, John P. Turtle, John E. Rasmussen, and Wayne I. Klemetti Apr. 1978 82 p refs
(AF Proj. 4600)
(AD-A060918; RADC-TR-78-95) Avail: NTIS HC A05/MF A01 CSCL 20/14

This report provides a summary of high latitude ionospheric reflectivity as observed by the USAF high resolution VLF/LF ionosounder operating in northern Greenland. Ionospheric reflectivity parameters, including reflection heights and coefficients, are presented as a function of time of day. VLF long path propagation measurements, along with magnetometer and riometer data, are presented as supplementary information. Author (GRA)

N79-15500# Rockwell International Science Center, Thousand Oaks, Calif. Science Center.
EVALUATION OF THE AC AND DC CHARACTERISTICS OF ROCK CONDUCTIVITY Final Report, 1 Feb. 1976 - 31 Jul. 1978
R. M. Housley and J. R. Oliver 27 Sep. 1978 63 p refs
(Contract N00014-76-C-0653)
(AD-A060396; SC5061.1FR) Avail: NTIS HC A04/MF A01 CSCL 08/7

Results are presented on the ac and dc characteristics of Wausau granite which show that excess ac losses at low temperatures are associated with cracks sealed by rutile, and are independent of any new open cracks. Data is also presented on the effect of surface hydration and contamination in old weathered cracks. Pyroxene was found to be the apparent major conducting phase in Mellen gabbro using a new scanning electron microscope technique. Author (GRA)

N79-15501# Texas Univ. at El Paso. Dept. of Electrical Engineering.
A SUBSONIC GERDIEN CONDENSER EXPERIMENT FOR UPPER ATMOSPHERIC RESEARCH Special Report, period ending 16 Jun. 1978
R. S. Sagar and J. D. Mitchell Aug. 1978 55 p refs
(Contract DAAD07-74-C-0263; DA Proj. 1L1-61102-B-53A)
(AD-A060433; ERADCOM/ASL-CR-78-0263-3) Avail: NTIS HC A04/MF A01 CSCL 04/1

This research is concerned with the design of a Gerdien condenser experiment suitable for flight on a standard meteorological rocket. After separating from the rocket at apogee, the instrument descends on a stabilized parachute system, telemetering the data back to ground while in flight. The theory of charged particle collection is presented for the Gerdien condenser. Also, the electrical and mechanical design for the particular system is discussed. GRA

N79-15502# Air Force Geophysics Lab., Hanscom AFB, Mass.
REMOTE IONOSPHERIC MONITORING Interim Report
Jurgen Buchau, William N. Hall, Bodo W. Reinish, and Sheryl Smith 16 Oct. 1978 12 p refs
(AF Proj. 4643)
(AD-A060617; AFGL-TR-78-0242) Avail: NTIS HC A02/MF A01 CSCL 04/1

A program for the development of automatic real-time monitoring of the ionosphere at a remote observing location is described. The Digisonde 128, a digital sounder in routine operation since 1970, provides digital data suitable for online computer processing. Analytical methods for the detection of ionospheric echoes and the determination of their virtual height, amplitude, and range spread have been developed. For real time application, these methods have been implemented in hardware using microprocessors. The Geomonitor, in addition to analyzing vertical and backscatter digital ionograms, digitizes magnetometer, riometer, radio polarimeter, and satellite scintillation data for transmission to the using site. Compression of the digital ionogram data and the other geophysical and ionospheric data permits transmission over a 600-1200 baud telecommunications link to the GDS. The GDS formats and displays the data for the remote observer and analyzes the data to call attention to disturbances. GRA

N79-15503# Ballistic Research Labs., Aberdeen Proving Ground, Md. Ballistics Research Lab.
SOURCE: A FORTRAN-4 SUBROUTINE PACKAGE THAT MODELS SEVERAL NATURALLY OCCURRING ENERGY INPUTS TO THE MESOSPHERE
Irving L. Chidsey Aug. 1978 50 p refs
(AD-A060612; AD-E430108; ARBRL-TR-02093) Avail: NTIS HC A03/MF A01 CSCL 04/1

This report documents the natural energy input models used in the BENCHMARK-76 and ECLIPSE-66 studies. Energy sources included are solar X-rays, solar ultra-violet and visible light, galactic cosmic rays, and precipitated electrons. These energy sources and their interactions with the atmosphere were modeled over the range 40-100 km altitude. Author (GRA)

N79-15504# Air Force Geophysics Lab., Hanscom AFB, Mass.
RADIO AND OPTICAL DIAGNOSTICS APPLIED TO AN ISOLATED EQUATORIAL SCINTILLATION EVENT Interim Report
J. Buchau, E. J. Weber, and J. P. McClure (Texas Univ. at Dallas) 1978 11 p refs Presented at the 1978 Symp. on the Effect of the Ionosphere on Space and Terrestrial Systems (IES 78), Arlington, Va., Jan. 1978; sponsored by ONR and NRL
(AD-A059865; AFGL-TR-78-0225) Avail: NTIS HC A02/MF A01 CSCL 04/1

During equatorial scintillation studies carried out in March 1977, a new all-sky spectrophotometric imaging system and an ionospheric sounder were operated to monitor the development, structure, and motion of F region irregularities leading to scintillations on satellite signals. The imaging system provided all-sky pictures of the 6300 OI airglow emission, which results from dissociative recombination of O2(+) in the F region. This technique provided minute by minute images of the large scale structure of the bottomside F-layer. Initial observations show the existence of north-south aligned regions of airglow depletion. GRA

N79-15505# Pennsylvania State Univ., University Park. Dept. of Geosciences.

RELATIONSHIP BETWEEN NEAR-FIELD AND TELESEISMIC OBSERVATIONS OF SEISMIC SOURCE PARAMETERS Final Report, 1 Apr. 1973 - 30 Sep. 1977

S. S. Alexander Jul. 1978 133 p refs
(Grant AF-AFOSR-2515-73; ARPA Order 1827)
(AD-A059529; AFOSR-78-1260TR) Avail: NTIS HC A07/MF A01 CSCL 17/10

The overall objective was to establish the connection between source mechanism parameters inferred from seismic measurements made relatively near to earthquakes and explosions and those inferred from teleseismic observations. There were significant variations in body-wave and surface wave excitation for explosions of comparable magnitude detonated in similar source media and located only a few kilometers apart. These observed differences in excitation and energy partitioning implied either a rapidly varying tectonic stress field in the source region and/or strongly varying patterns of near-source fracturing. Source-generated P-wave code of two minutes duration or more were observed to vary significantly in strength and character, possibly due to short-period surface wave to P-wave scattering. GRA

N79-15506# Air Force Geophysics Lab., Hanscom AFB, Mass.

AMPLITUDE SCINTILLATION STUDIES IN THE POLAR REGION ON 250 MHz

J. Buchau, J. Aarons, J. P. Mullen, E. J. Weber, J. A. Whalen, H. E. Whitney, and E. E. Crampton, Jr. (Mitre Corp., Bedford, Mass.) 28 Sep. 1978 10 p refs Presented at the 1978 Symp. on the Effect of the Ionosphere on Space and Terrest. Systems (IES 78), Arlington, Va., Jan. 1978; sponsored by ONR and NRL
(AD-A059864; AFGL-TR-0226) Avail: NTIS HC A02/MF A01 CSCL 04/1

In April, July and September 1975 twelve C-141 flights (28 hours of data) were conducted to measure amplitude scintillations on VHF satellite transmissions in the polar region, under auroral conditions. A second aircraft, a KC-135, instrumented for ionospheric/auroral research, monitored the conditions of the auroral ionosphere in the ray path to relate scintillation events to auroral conditions in the April and September tests. Simultaneous ground measurements were made at Thule, Greenland; Goose Bay, Labrador, Canada; and Sagamore Hill, Massachusetts. For the first time in the polar region satellite 250 MHz transmissions could be monitored for an extended period (up to 4 hours) at high elevation angles. Author

N79-15507# National Oceanic and Atmospheric Administration, Boulder, Colo.

IONOSPHERIC D-REGION PROFILE DATA BASE. A COLLECTION OF COMPUTER-ACCESSIBLE EXPERIMENTAL PROFILES OF THE D AND LOWER E REGIONS

L. F. McNamara (Ionospheric Prediction Service, Sydney) Aug. 1978 35 p refs
(PB-287867/6; UAG-67) Avail: NTIS HC A03/MF A01 CSCL 04A

A collection of some 700 experimental electron density profiles of the D and lower E regions of the ionosphere was digitized and made computer-retrievable. The collection includes most of the profiles published in the journal or report literature. The data are available in the form of three computer files that give the conditions under which each profile was obtained, a full list of references from which the experimental data were extracted, and the digitized profiles themselves. GRA

N79-15508# Desert Research Inst., Reno, Nev. Water Resources Center.

MAPPING OF EARTH FISSURES IN LAS VEGAS VALLEY, NEVADA

R. O. Patt and G. B. Maxey Mar. 1978 28 p refs
(OWRT Proj. A-071-Nev(1))
(PB-286969/1; PUB-41051; W78-12107) Avail: NTIS HC A03/MF A01 CSCL 08G

Seven zones of fissuring in the vicinity of Las Vegas are outlined and discussed. Fissures in Las Vegas Valley can be correlated with the following features: (1) fault scarps (compaction or tectonic); (2) well fields; and (3) tectonic activity. Several features are noted which may be interrelated with subsidence and fissuring in Las Vegas Valley. Damage to streets and homes as a result of fissuring is discussed. GRA

N79-15509# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.

SOLAR ABSORPTION IN CLOUDS OF FINITE HORIZONTAL EXTENT M.S. Thesis

John M. Davis, Stephen K. Cox, and Thomas B. McKee Jan. 1978 106 p refs
(Grants NSF ATM-77-15369; NSF OCD-74-21678)
(PB-286834/7; AS-PAPER-282) Avail: NTIS HC A06/MF A01 CSCL 04A

A model which includes the effects of water vapor and droplet absorption in finite cloud radiative transfer calculations is described. Total spectral (0.3 to 8.0 micrometer) values of directional reflectance of finite clouds are calculated and compared to values corresponding to horizontally infinite clouds of the same optical thickness. Absorption of solar radiation in finite clouds is compared to absorption in an equal volume element of horizontally infinite clouds. Absorptions above and below the geometrically different clouds are also compared as well as total spectral values of surface solar irradiance. Horizontally non-homogeneous values of absorption for the regions in and adjoining the finite cloud are presented. A total spectral, time and space averaged radiative budget is calculated for a totally absorbing surface partially covered by finite clouds. The results indicate that finite cloud effects have a significant impact on such calculations as a result of exposure of the vertical cloud wall to direct solar radiation. GRA

N79-15510# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.

MAGNITUDE OF THE RADIATIVE EFFECTS OF THE SAHARAN DUST LAYER M.S. Thesis

Patrick Minnis and Stephan K. Cox Jan. 1978 129 p refs
(Grants NSF OCD-74-21678; NSF ATM-77-15369)
(PB-286835/4; AS-PAPER-283; ISSN-0067-0340) Avail: NTIS HC A07/MF A01 CSCL 04A

The shortwave and longwave properties of the Saharan dust layer are studied using broadband hemispheric irradiance data and numerical radiative transfer routines. The analyzed data were collected during the GARP Atlantic Tropical Experiment (GATE) in the summer of 1974. The solar heating rates, fractional absorptions and reflectivities, as well as the longwave effective emissivities and cooling rates for the 550-950 mb layer are determined for both clear and dusty days. These parameters are compared to corresponding parameters derived with the aid of two broadband radiative transfer routines which use the observed temperature and moisture data. The magnitude of the dust effects are determined by differencing the measured and computed results. GRA

N79-15511# Environmental Monitoring and Support Lab., Las Vegas, Nev. Monitoring Systems Research and Development Div.

FACTORS INFLUENCING THE VOLATILIZATION OF MERCURY FROM SOIL Final Report

Robert D. Rogers and James C. McFarlane May 1978 20 p refs
(PB-286179/7; EPA-600/3-78-054) Avail: NTIS HC A02/MF A01 CSCL 08M

Mercury volatilization from soils amended to 1 ppm mercury with mercuric nitrate ceased within 1 week after application. During the first week, 20% of the applied mercury was lost from a silty clay-loam soil and 43% was lost from a loamy sand soil. Volatilization of Hg from the loamy sand soil resulted

in a concurrent decrease in ammonium nitrate-extractable mercury. Other work with sterile soil indicates that the volatilization was mediated by microorganisms. GRA

N79-15512# Shannon and Wilson, Inc., Seattle, Wash.
GEOTECHNICAL AND STRONG MOTION EARTHQUAKE DATA FROM US ACCELEROGRAPH STATIONS, PASADENA (CIT MILLIKAN LIBRARY), SANTA BARBARA COUNTY COURT HOUSE, TAFT (LINCOLN SCHOOL TUNNEL) AND HOLLISTER (MELENDY RANCH BARN), CALIFORNIA, VOLUME 2
Jun. 1978 295 p refs Prepared in cooperation with Agbabian Associates
(Contract AT(49-24)-0029)
(PB-283187/3; NUREG-0029-Vol-2) Avail: NTIS HC A13/MF A01 CSCL 08K

Seismic and geotechnical data for four accelerograph stations located in the southern and central part of California are presented. These stations are located at: CIT Millikan Library, Santa Barbara Court House, Taft and Melendy Ranch Barn, Hollister. Included along with the geotechnical data, in this report are descriptions of each accelerograph station, discussions of the seismicity of each site, and a catalog of seismic events. Also, selected ground motion-time histories and their corresponding response spectra are provided. GRA

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N79-15513*# Tennessee Univ. Space Inst., Tullahoma.
A FIELD STUDY OF AIR FLOW AND TURBULENT FEATURES OF ADVECTION FOG
J. D. Connell Jan. 1979 52 p refs
(Contract NAS8-32031; M-279)
(NASA-CR-3095) Avail: NTIS HC A04/MF A01 CSCL 04B

The setup and initial operation of a set of specialized meteorological data collection hardware are described. To study the life cycle of advection fogs at a lake test site, turbulence levels in the fog are identified, and correlated with the temperature gradients and mean wind profiles. A meteorological tower was instrumented to allow multiple-level measurements of wind and temperature on a continuous basis. Additional instrumentation was: (1)hydrothermograph, (2)microbarograph, (3)transmissometers, and (4)a boundary layer profiler. Two types of fogs were identified, and important differences in the turbulence scales were noted. S.E.S.

N79-15514*# Stanford Research Inst., Menlo Park, Calif.
AIRBORNE MEASUREMENT OF ELECTROMAGNETIC ENVIRONMENT NEAR THUNDERSTORM CELLS, TRIP-76 Final Report
J. E. Nanevicz, R. C. Adamo, and R. T. Bly, Jr. Aug. 1977 78 p refs
(Contract NAS9-15101)
(NASA-CR-157642; AD-A060875; AFFDL-TR-77-62) Avail: NTIS HC A05/MF A01 CSCL 04/2

The increasing use of digital equipment and nonmetallic structures on aerospace vehicles has focused new attention on the potential electromagnetic threat posed by the lightning and thunderstorm environment. To better define this threat, a quick reaction airborne lightning measurement effort was undertaken. Digital 'snapshot' data and continuous analog spectrum analyzer data were alternately recorded on an instrumented NASA Learjet during 29 flights. Recorded events included one direct lightning strike and many nearby strikes, as well as 'incipient lightning' streamers and non-lightning-associated signals. A comparison with nuclear EMP waveforms is given, indicating nearby lightning to be a far more energetic threat than EMP at low frequencies, and that it is non-negligible at 10 MHz and above. GRA

N79-15515# Naval Postgraduate School, Monterey, Calif.
EVAPORATION DUCT HEIGHT MEASUREMENTS IN THE MID-ATLANTIC Final Report, Feb. - Mar. 1978
C. W. Fairall, K. L. Davidson, G. E. Schacher, T. M. Houlihan, and Jeff Haltiner 15 Aug. 1978 136 p refs
(AD-A060451; NPS61-78-005) Avail: NTIS HC A07/MF A01 CSCL 20/14

This is a report on atmospheric boundary layer measurements made aboard the USNS Kane in February and March of 1978. The data has been analyzed to obtain Monin-Obukhov similarity parameters and EM propagation properties using bulk, profile and turbulence data. The evaporation duct height, Z^*, was found to vary from 1.0 meters to 25 meters with a typical value of 16 meters. A comparison with profile and turbulence methods showed that the bulk method was accurate to within a factor of two, although some of the disagreement has been attributed to profile measurement inaccuracies. A sensitivity analysis showed that the relative humidity and air-sea temperature difference are the most critical measurements for bulk calculations of Z^*. GRA

N79-15516# Naval Weather Service Detachment, Asheville, N. C.
SUMMARY OF METEOROLOGICAL OBSERVATIONS, SURFACE (SMOS), FUTENMA, OKINAWA Performance Report, 1960 - 1977
Jul. 1978 354 p
(AD-A060538) Avail: NTIS HC A16/MF A01 CSCL 04/2

This data report consists of a six part statistical summary of surface weather observations. The six parts are: Part A - Weather Conditions/Atmospheric Phenomena, Part B Precipitation/Snowfall/Snow Depth, Part C - Surface Winds, Part D - Ceiling versus Visibility/Sky Cover, Part E - Psychrometric Summaries, and Part F - Station Pressure/Sea Level Pressure. Author (GRA)

N79-15517# Naval Weather Service Detachment, Asheville, N. C.
SUMMARY OF METEOROLOGICAL OBSERVATIONS, SURFACE (SMOS), CUBI POINT, PHILIPPINES Reference Report, 1955 - 1977
Jul. 1978 355 p
(AD-A060539) Avail: NTIS HC A16/MF A01 CSCL 04/2

This data report consists of a six part statistical summary of surface weather observations. The six parts are: Part A - Weather Conditions/Atmospheric Phenomena, Part B Precipitation/Snowfall/Snow Depth, Part C - Surface Winds, Part D - Ceiling versus Visibility/Sky Cover, Part E - Psychrometric Summaries, and Part F - Station Pressure/Sea Level Pressure. Author (GRA)

N79-15518# Naval Weather Service Detachment, Asheville, N. C.
SUMMARY OF METEOROLOGICAL OBSERVATIONS, SURFACE (SMOS), BERMUDA Reference Report, 1949 - 1977
Jun. 1978 355 p
(AD-A060540) Avail: NTIS HC A16/MF A01 CSCL 04/2

This data report consists of a six part statistical summary of surface weather observations. The six parts are: Part A - Weather Conditions/Atmospheric Phenomena, Part B Precipitation/Snowfall/Snow Depth, Part C - Surface Winds, Part D - Ceiling versus Visibility/Sky Cover, Part E - Psychrometric Summaries, and Part F - Station Pressure/Sea Level Pressure. Author (GRA)

N79-15519# Naval Weather Service Detachment, Asheville, N. C.
SUMMARY OF METEOROLOGICAL OBSERVATIONS, SURFACE (SMOS), CECIL FIELD, FLORIDA Reference Report, 1947 - 1977
Jun. 1978 362 p
(AD-A060541) Avail: NTIS HC A16/MF A01 CSCL 04/2

This data report consists of a six part statistical summary of surface weather observations. The six parts are: Part A - Weather Conditions/Atmospheric Phenomena, Part B Precipitation/Snowfall/Snow Depth, Part C - Surface Winds, Part D - Ceiling versus Visibility/Sky Cover, Part E - Psychrometric Summaries, and Part F - Station Pressure/Sea Level Pressure. Author (GRA)

N79-15520# Naval Weather Service Detachment, Asheville, N. C.
SUMMARY OF METEOROLOGICAL OBSERVATIONS, SURFACE (SMOS), CHERRY POINT, NORTH CAROLINA Reference Report, 1945 - 1977
Jun. 1978 370 p refs
(AD-A060542) Avail: NTIS HC A16/MF A01 CSCL 04/2
This data report consists of a six part statistical summary of surface weather observations. The six parts are: Part A - Weather Conditions/Atmospheric Phenomena, Part B Precipitation/Snowfall/Snow Depth, Part C - Surface Winds, Part D - Ceiling versus Visibility/Sky Cover, Part E - Psychrometric Summaries, Part F - Station Pressure/Sea Level Pressure.
Author (GRA)

N79-15521# Naval Weather Service Detachment, Asheville, N. C.
SUMMARY OF METEOROLOGICAL OBSERVATIONS, SURFACE (SMOS), NORFOLK, VIRGINIA Reference Report, 1945 - 1977
Jul. 1978 371 p
(AD-A060543) Avail: NTIS HC A16/MF A01 CSCL 04/2
This data report consists of a six part statistical summary of surface weather observations. The six parts are: Part A - Weather Conditions/Atmospheric Phenomena, Part B Precipitation/Snowfall/Snow Depth, Part C - Surface Winds, Part D - Ceiling versus Visibility/Sky Cover, Part E - Psychrometric Summaries, Part F - Station Pressure/Sea Level Pressure.
Author (GRA)

N79-15522# Naval Weather Service Detachment, Asheville, N. C.
SUMMARY OF METEOROLOGICAL OBSERVATIONS, SURFACE (SMOS), JACKSONVILLE, FLORIDA Reference Report, 1945 - 1977
Jul. 1978 373 p
(AD-A060544) Avail: NTIS HC A16/MF A01 CSCL 04/2
This data report consists of a six part statistical summary of surface weather observations. The six parts are: Part A - Weather Conditions/Atmospheric Phenomena, Part B Precipitation/Snowfall/Snow Depth, Part C - Surface Winds, Part D - Ceiling versus Visibility/Sky Cover, Part E - Psychrometric Summaries, Part F - Station Pressure/Sea Level Pressure.
Author (GRA)

N79-15523# Naval Weather Service Detachment, Asheville, N. C.
SUMMARY OF METEOROLOGICAL OBSERVATIONS, SURFACE (SMOS), AGANA, GUAM Reference Report, 1945 - 1977
Jun. 1978 363 p
(AD-A060606) Avail: NTIS HC A16/MF A01 CSCL 04/2
This data report consists of a six part statistical summary of surface weather observations. The six parts are: Part A - Weather Conditions/Atmospheric Phenomena, Part B Precipitation/Snowfall/Snow Depth, Part C - Surface Winds, Part D - Ceiling versus Visibility/Sky Cover, Part E - Psychrometric Summaries, Part F - Station Pressure/Sea Level Pressure.
Author (GRA)

N79-15524# Naval Weather Service Detachment, Asheville, N. C.
SUMMARY OF METEOROLOGICAL OBSERVATIONS, SURFACE (SMOS), CHINA LAKE, CALIFORNIA Reference Report, 1945 - 1977
Jul. 1978 332 p
(AD-A060546) Avail: NTIS HC A15/MF A01 CSCL 04/2
This data report consists of a six part statistical summary of surface weather observations. The six parts are: Part A - Weather Conditions/Atmospheric Phenomena, Part B precipitation/Snowfall/Snow Depth, Part C - Surface Winds, Part D - Ceiling versus Visibility/Sky Cover, Part E - Psychrometric Summaries, Part F - Station Pressure/Sea Level Pressure.
Author (GRA)

N79-15525# Naval Weather Service Detachment, Asheville, N. C.
SUMMARY OF METEOROLOGICAL OBSERVATIONS, SURFACE (SMOS), FALLON, NEVADA Reference Report, 1945 - 1977
Jul. 1978 357 p
(AD-A060545) Avail: NTIS HC A16/MF A01 CSCL 04/2
This data report consists of a six part statistical summary of surface weather observations. The six parts are: Part A - Weather Conditions/Atmospheric Phenomena, Part B Precipitation/Snowfall/Snow Depth, Part C - Surface Winds, Part D - Ceiling versus Visibility/Sky Cover, Part E - Psychrometric Summaries, and Part F - Station Pressure/Sea Level Pressure.
Author (GRA)

N79-15526# Naval Weather Service Detachment, Asheville, N. C.
SUMMARY OF METEOROLOGICAL OBSERVATIONS, SURFACE (SMOS), KEFLAVIK, ICELAND Reference Report, 1949 - 1977
Jul. 1978 366 p
(AD-A060607) Avail: NTIS HC A16/MF A01 CSCL 04/2
This data report consists of a six part statistical summary of surface weather observations. The six parts are: Part A - Weather Conditions/Atmospheric Phenomena, Part B Precipitation/Snowfall/Snow Depth, Part C - Surface Winds, Part D - Ceiling versus Visibility/Sky Cover, Part E - Psychrometric Summaries, Part F - Station Pressure/Sea Level Pressure.
Author (GRA)

N79-15527# Naval Weather Service Detachment, Asheville, N. C.
SUMMARY OF METEOROLOGICAL OBSERVATIONS, SURFACE (SMOS), DALLAS, TEXAS Reference Report, 1945 - 1977
Jul. 1978 372 p
(AD-A060610) Avail: NTIS HC A16/MF A01 CSCL 04/2
This data report consists of a six part statistical summary of surface weather observations. The six parts are: Part A - Weather Conditions/Atmospheric Phenomena, Part B Precipitation/Snowfall/Snow Depth, Part C - Surface Winds, Part D - Ceiling versus Visibility/Sky Cover, Part E - Psychrometric Summaries, Part F - Station Pressure/Sea Level Pressure.
Author (GRA)

N79-15528# Naval Weather Service Detachment, Asheville, N. C.
SUMMARY OF METEOROLOGICAL OBSERVATIONS, SURFACE (SMOS), ADAK, ALASKA Reference Report, 1950 - 1977
Jun. 1978 355 p refs
(AD-A060609) Avail: NTIS HC A16/MF A01 CSCL 04/2
This data report consists of a six part statistical summary of surface weather observations. The six parts are: Part A - Weather Conditions/Atmospheric Phenomena,, Part B Precipitation/Snowfall/Snow Depth, Part C - Surface Winds, Part D - Ceiling versus Visibility/Sky Cover, Part E - Psychrometric Summaries, Part F - Station Pressure/Sea Level Pressure.
Author (GRA)

N79-15529# Naval Weather Service Detachment, Asheville, N. C.
SUMMARY OF METEOROLOGICAL OBSERVATIONS, SURFACE (SMOS), LEMOORE, CALIFORNIA Reference Report, 1961 - 1977
Jul. 1978 365 p
(AD-A060608) Avail: NTIS HC A16/MF A01 CSCL 04/2
This data report consists of a six part statistical summary of surface weather observations. The six parts are: Part A - Weather Conditions/Atmospheric Phenomena, Part B Precipitation/Snowfall/Snow Depth, Part C - Surface Winds, Part D - Ceiling versus Visibility/Sky Cover, Part E - Psychrometric Summaries, Part F - Station Pressure/Sea Level Pressure.
Author (GRA)

N79-15530# Honeywell, Inc., Hopkins, Minn.
MINI-REFRACTION SONDE LABORATORY TESTS Final Report
C. Motchenbacher 30 Dec. 1977 76 p
(Contract N62269-76-C-0368)
(AD-A057416, NADC-76128-30-A) Avail: NTIS

HC A05/MF A01 CSCL 04/2

The feasibility of building a small, lightweight meteorological sonde capable of measuring index of refraction (Mini-Refraction Sonde), which can be launched with a 30 gram Pibal balloon is demonstrated. The minisonde uses a rod thermister for temperature and a carbon hygrister for humidity measurement. For pressure measurement, a silicon diaphragm barometer was used. To commutate between the temperature, pressure, and humidity sensors and encode the meteorological data measurements, a set of meteorological electronics was developed using commercially available integrated circuits. G.Y.

N79-15531# Naval Environmental Prediction Research Facility, Monterey, Calif.

EXTRATROPICAL STORM EVOLUTION FROM TROPICAL CYCLONES IN THE WESTERN NORTH PACIFIC OCEAN

Samson Brand and Charles P. Guard Jul. 1978 26 p refs

(AD-A060910; NEPRF-TR-78-02) Avail: NTIS HC A03/MF A01 CSCL 04/2

This study examines 16 recurving tropical storms and typhoons that occurred in the western North Pacific Ocean in 1971, to determine the characteristics of the storms after they became extratropical. Many of the extratropical storms that evolved from tropical cyclones maintained destructive seas and winds as long as 5 days after the point of recurvature. Six of the 16 extratropical storms crossed the North Pacific and affected the Aleutians or western North America. Some of the physical processes associated with the evolution of extratropical storms from tropical cyclones are also discussed. Author (GRA)

N79-15532# Naval Research Lab., Washington, D. C.

JOINT SERVICES 5D-2 MICROWAVE SCANNER DEFINITION STUDY Progress Report, 1 Jul. 1977 - 1 Apr. 1978

J. P. Hollinger, R. M. Lerner, B. E. Troy, and M. M. Wisler Aug. 1978 67 p refs

(WF52553701)

(AD-A060740; AD-E000210; NRL-MR-3807) Avail: NTIS HC A04/MF A01 CSCL 04/2

This progress report presents the results obtained to date by the Naval Research Laboratory from their participation in the Joint-Services Microwave Definition Study. This is a joint Navy/Air Force effort to develop a microwave scanning system for the Defense Meteorological Satellite Program (DMSP) to provide all weather, global measurements of the sea surface winds, temperature and ice cover, precipitation over land and sea, and atmospheric liquid water and water vapor to support Department of Defense world-wide military operations. Three tasks are addressed. Task 1 is a sensor performance analysis, system trade-off study and algorithm development program utilizing a theoretical/empirical environmental model and a statistical description of the environmental parameters. Results are presented of a comparison of selected candidate sensor system with regard to their relative accuracy in measuring the desired surface and atmospheric environmental properties. Task 2 is to develop a complete set of statistics necessary for Task 1. It consists of deriving the means and covariance matrix for all of the desired environmental parameters. In all twelve matrices are being computed corresponding to arctic, temperate and tropic latitudes under spring, summer, fall and winter conditions. Task 3 is to conduct a flight program using the NRL RP3-A aircraft and sensor complement to obtain microwave measurements of marine wind speed, atmospheric liquid water and water vapor, and precipitation over land and ocean to evaluate sensor performance models and data reduction algorithms. The results of the flight program in September 1977 to measure precipitation over land and sea are presented. Author (GRA)

N79-15533# Air Force Global Weather Central, Offutt AFB, Nebraska.

THE AFGWC AUTOMATED CLOUD ANALYSIS MODEL

F. K. Fye Jun. 1978 109 p

(AD-A057176; AFGWC-TM-78-002) Avail: NTIS HC A06/MF A01 CSCL 04/2

The Air Force Global Weather Central (AFGWC) automated cloud analysis program (3DNEPH) produces high resolution, three dimensional analyses of clouds over the entire globe. Up to eight analyses are scheduled per day with additional limited analyses available on request. The program is a string of individual modules which process and integrate meteorological cloud information from surface, pilot, and upper air reports. An additional capability to interpret and incorporate visual and infrared satellite imagery results in high resolution, worldwide coverage. Recent advances in the techniques and methodology for interpreting satellite imagery are described. A manual data input processor, quality control procedures, and applications are also described. An appendix provides information on the high resolution terrain, geography, temperature, and background brightness fields used to support the model. Author

N79-15534# Naval Weather Service Detachment, Asheville, N. C.

SUMMARY OF METEOROLOGICAL OBSERVATION, SURFACE (SMOS), IWAKUNI, JAPAN Reference Report, 1952 - 1977

Jul. 1978 357 p

(AD-A060537) Avail: NTIS HC A16/MF A01 CSCL 04/2

This data report consists of a six part statistical summary of surface weather observations. The six parts are: Part A - Weather Conditions/Atmospheric Phenomena, Part B Precipitation/Snowfall/Snow Depth, Part C - Surface Winds, Part D - Ceiling Versus Visibility/Sky Cover, Part E - Psychrometric Summaries, and Part F - Station Pressure/Sea Level Pressure. Author (GRA)

N79-15535# National Technical Information Service, Springfield, Va.

WEATHER MODIFICATION EFFECTS AND MANAGEMENT. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Oct. 1978

Robena J. Brown Nov. 1978 232 p Supersedes NTIS/PS-77/1106; NTIS/PS-76/0931; NTIS/PS-75/722; NTIS/PS-75/078 (NTIS/PS-78/1226/6; NTIS/PS-77/1106; NTIS/PS-76/0931; NTIS/PS-75/722; NTIS/PS-75/078) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 04B

Adverse and beneficial effects, effect on climate, legal aspects, ecological effects, and effect on water supplies are reported. Studies related to the management and utilization of weather modification to increase the water supply in arid regions are included. This updated bibliography contains 227 abstracts, 23 of which are new entries to the previous edition. GRA

N79-15536# National Weather Service, Silver Spring, Md. Office of Hydrology.

PROBABLE MAXIMUM PRECIPITATION ESTIMATES, UNITED STATES EAST OF THE 105TH MERIDIAN

Louis C. Schreiner and John T. Riedel Jun. 1978 95 p refs Sponsored in part by Army Corps of Engineers

(PB-287925/2; NOAA-NWS-HR-51; NOAA-78091201) Avail: NTIS HC A05/MF A01 CSCL 04B

Generalized estimates of Probable Maximum Precipitation, the greatest rainfall rates for specified durations theoretically possible, are presented for the United States east of the 105th meridian. They are all-season estimates, that is, the greatest for any time of year, for drainages from 10 to 20,000 sq mi (26 to 51,800 sq km) for duration of 6 to 72 hours. Details of the procedures and methods used for developing these estimates are described. GRA

N79-15537# National Oceanic and Atmospheric Administration, Washington, D. C. Environmental Data and Information Service.

MARINERS WEATHER LOG, VOLUME 22, NO. 5, SEPTEMBER 1978

Elwyn E. Wilson Sep. 1978 74 p

(PB-287358/6; NOAA-78091901) Avail: NTIS HC A04/MF A01 CSCL 04B

In addition to the regular sections this issue contains the following articles: The 1977-78 Southern California winter; Rapidly developing eastern North Pacific tropical cyclones; and eleven year chronicle of one of the world's most gigantic icebergs. GRA

N79-15538# Oklahoma Univ., Norman. School of Electrical Engineering.

WEATHER RADAR ECHO SIGNAL SIMULATOR Final Report

G. B. Walker, Thomas Benjamin, and Magsood Mohd Jun. 1978 71 p refs
(Grant NOAA-04-6-022-44033)
(PB-286875/0; NOAA-78083003) Avail: NTIS HC A04/MF A01 CSCL 04B

Research and development of a weather radar signal simulator are described. A review of representing weather echoes as narrow band Gaussian processes shows that a discrete function to approximate a realization of the Gaussian process with small error can be used. Equipment is designed, constructed, and tested to simulate the weather echo. The equipment, when used with the National Severe Storms Laboratory's 10 cm Doppler radar system, can calibrate the radar in a statistical sense. GRA

N79-15539# Systems Applications, Inc., San Rafael, Calif.
USER'S MANUAL FOR KINETICS MODEL AND OZONE ISOPLETH PLOTTING PACKAGE Interim Report
Gary Z. Whitten and H. Hogo Jul. 1978 249 p refs
(Contract EPA-68-02-2428)
(PB-286248/0; EPA-600/8-78-014A) Avail: NTIS HC A11/MF A01 CSCL 04B

The Kinetics Model and Ozone Isopleth Plotting Package (OZIPP) is a computerized model that simulates ozone formation in urban atmospheres. OZIPP calculates maximum one-hour average ozone concentrations given a set of input assumptions about initial precursor concentrations, light intensity, dilution, diurnal and spatial emission patterns, transported pollutant concentrations, and reactivity of the precursor mix. The results of multiple simulations are used to produce an ozone isopleth diagram tailored to particular cities. Such a diagram relates maximum ozone concentrations to concentrations of non-methane hydrocarbons and oxides of nitrogen, and can be used in the Empirical Kinetic Modeling Approach to calculate emission reductions necessary to achieve air quality standards for photochemical oxidants. This user's manual describes the technical basis, necessary and optional input data, computer code and the use of OZIPP. GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N79-15540# Naval Ocean Systems Center, San Diego, Calif.
THE EFFECT OF UPDATE RANDOMIZATION ON REVGEN OUTPUT: BROADBAND ENERGY DETECTOR Final Report, Apr. - Aug. 1978
J. G. Melville and M. E. Stegman 31 Aug. 1978 41 p refs
(AD-A060121; NOSC/TR-292) Avail: NTIS HC A03/MF A01 CSCL 08/10

Current advancements in computer simulation of ocean reverberation include the realtime implementation of REVGEN (Reverberation Generator). The REVGEN algorithm which determines the randomization and number of update components can significantly affect the form of the reverberation return and correspondingly alter the false alarm and detection statistics for the response of a broadband energy detector. When the updates are limited and assigned constant amplitudes, there is a reduction in the probability of high intensity returns which, in turn, affect detector performance in two ways: (1) For a given signal-to-noise ratio, a signal produced with updates of constant magnitude will result in erroneously low probability of false alarm (PFA); and (2) These lowered PFA rates cause incorrect placement of detection thresholds which then yield erroneously high probabilities of detection. Both theoretical calculations and computer simulation show that increasing the number of updates resolves the statistical disparity. However, the reverberation algorithm which randomizes the update amplitudes according to a Rayleigh distribution is seen to yield the proper statistics independent of the number of updates used in the simulation. This decoupling of the detection statistics from the update algorithm may, for some simulation applications, provide the opportunity to reduce REVGEN computational requirements. Author (GRA)

N79-15541# Naval Surface Weapons Center, Dahlgren, Va.
GLOBAL OCEAN TIDES. PART 1: A DETAILED HYDRODYNAMICAL INTERPOLATION MODEL Final Report
E. W. Schwiderski Sep. 1978 95 p refs
(ZR0000101)
(AD-A060913; NSWC/DL-TR-3866-Pt-1) Avail: NTIS HC A05/MF A01 CSCL 08/3

A new hydrodynamical interpolation technique has been developed and tested to construct a model of global ocean tides with the support of empirical tidal constants collected around the world. The discrete tide model features a 1 deg by 1 deg graded grid system in connection with a hydrodynamically defined bathymetry. The Laplace tidal equations are augmented by turbulent friction terms with novel mesh-area (latitude and depth) dependent eddy-viscosity and bottom-friction coefficients. The well-known astronomical tide-generating forces are modified by effects due to solid earth tides and ocean-tidal loading. New averaged finite differences in time are used to enhance stability characteristics and to facilitate the hydrodynamical interpolation of empirical data. This unique interpolation is accomplished by a controlled adjustment of the bottom-friction coefficient and by redefining a more physical shoreline. Extensive computer experiments were conducted to study the characteristics of the novel friction laws and hydrodynamical interpolation methods. The computed M2 tide data along with all (specially labeled) empirical constants are tabulated in map form for four typical 30 by 50 deg ocean areas. A complete tabulation and discussion of the computed M2 tide will be published in Part 2 of this report. It is estimated that the tabulated tidal charts permit a prediction of the M2-tide elevation of the ocean surface over the geoidal level with an accuracy of better than 5 cm anywhere in the open ocean and with somewhat less accuracy near rough shorelines. GRA

N79-15542# Woods Hole Oceanographic Institution, Mass.
A COMPILATION OF MOORED CURRENT DATA AND ASSOCIATED OBSERVATIONS MODE-SITE VOLUME 14 (1971 - 1975)
Susan Tarbell and Ann Spencer Mar. 1978 56 p refs
(Contracts N00014-66-C-0241; N00014-74-C-0262; Contract N00014-76-C-0197; Grants NSF GX-29054; NSF OCE-75-03962; NR Proj. 083-004; NR Proj. 083-400)
(AD-A060355; WHOI-78-5) Avail: NTIS HC A04/MF A01 CSCL 08/3

Current, temperature and pressure measurements from instruments moored in the MODE area during the years 1971-1975 are presented. Record lengths vary from 2 weeks to 7 months. Data from individual instruments are displayed in the form of statistical tables, spectral plots and variables vs. time plots. Current data are additionally displayed as progressive vector plots. Composite plots of temperature, pressure or velocity are included for groups of records which could be combined to show a meaningful spatial or temporal array. Selected CTD data are included and displayed as potential temperature and salinity versus pressure. Author (GRA)

N79-15543# Delaware Univ., Newark. Coll. of Marine Studies.
DECISIONS FOR DELAWARE: SEA GRANT LOOKS AT BEACH MANAGEMENT
Paul A. Jensen, Robert A. Dalrymple, and Bruce W. Lee Aug. 1978 33 p refs Sponsored by NOAA, Office of Sea Grant
(PB-287922/9; DEL-SG-7-78; NOAA-78090702) Avail: NTIS HC A03/MF A01 CSCL 13B

Along Delaware's coast, natural processes cause erosion at a rate of 3 to 9 feet each year in some places. Severe storms--for which Delaware is essentially unprepared--may cause considerable property damage and threaten the lives of many people. The situation has prompted demands for protective actions which in many cases have proven expensive and not very effective. Sea level continues to rise about 5 inches each century. Because of the orientation of Delaware's coast, waves produce a longshore current that scours sand from the beach and carries it northward. Nothing can be done to permanently halt the loss of land to the sea. GRA

N79-15544# Fish and Wildlife Service, NSTL Station, Miss.
CONTRIBUTED PAPERS ON COASTAL ECOLOGICAL CHARACTERIZATION STUDIES
James B. Johnston and Lee A. Barclay Apr. 1978 73 p refs

Presented at the 4th Biennial Intern. Estuarine Res. Federation Conf., Mt. Pocono, Pa., 2-5 Oct. 1977 Sponsored in part by EPA, Cincinnati, Ohio
(PB-286564/0; FWS/OBS-77/37) Avail: NTIS HC A04/MF A01 CSCL 13B

The six papers are: (1) Coastal Ecological Characterization--An Overview; (2) Ecosystem Characterization--An Approach to Coastal Planning and Management; (3) Evaluation of Methodology Used in Ecological Characterization of the Chenier Plain; (4) User-Oriented Conceptual Modeling in the Ecological Characterization of the Sea Island and Coastal Plains of South Carolina and Georgia; (5) The Construction of a Conceptual Model of the Chenier Plain Coastal Ecosystem in Louisiana and Texas; (6) Maine Coast Characterization User's Guide. GRA

N79-15545# Chicago Univ., Ill. Dept. of Geophysical Sciences.
FIELD MEASUREMENTS OF THE BOTTOM FRICTIONAL BOUNDARY LAYER IN THE NEW YORK BIGHT
Aug. 1978 177 p refs
(Contract NOAA-03-3-022-111)
(PB-288194/4; NOAA-TM-ERL-MESA-28; NOAA-78091203) Avail: NTIS HC A09/MF A01 CSCL 08C

A detailed field study of the bottom frictional boundary layer on the inner continental shelf in the apex of the New York Bight used an instrumentation system designed to measure horizontal velocities at three levels within 1 meter of the bottom, the pressure fluctuations due to surface waves, the direction of the mean current and the turbidity 15 cm above the sea floor. The four experiments of the study were designed to investigate the influence of the higher frequency (up to 0.3 Hertz) components of the flow on the structure of the bottom boundary layer and on sediment-transport in typical inner continental shelf environments. They were conducted in waters 18 to 20 meters deep over coarse sand, medium sand, and muddy silt bottoms. GRA

N79-15546# Scripps Institution of Oceanography, La Jolla, Calif.
DESCRIPTION OF CORES FROM THE PACIFIC AND INDIAN OCEANS TAKEN ON ANTIPODE EXPEDITION Final Report
Carolyn Glockhoff May 1978 83 p refs
(Grant NSF OCE-76-81868)
(PB-288040/9; SIO-REF-78-17; SIO/CORES-5) Avail: NTIS HC A05/MF A01 CSCL 08I

Deep-sea sediment cores from the ANTIPODE Expedition were described to identify visually distinct units based on color, texture, or other feature, sedimentary structures, lithology and abundance of component grains, and paleontology. Sixty-eight cores were examined, of which 34 are large diameter poston cores. Photographs and graphic lithology logs are included. The ANTIPODE Expedition recovered cores from: the Monterey-Ascension Fan, the Northeast Pacific, the Aleutians, the Northwest Pacific, the Philippine Sea, Indonesia, the Tonga Ridge, the Seychelles, Chagos Archipelago, the Mid-Indian Ridge, the Bay of Bengal, near Sumatra, and near Cocos island in the Indian Ocean. GRA

N79-15547# Oregon State Univ., Corvallis. School of Oceanography.
A COMPILATION OF OBSERVATIONS FROM MOORED CURRENT METERS. VOLUME 12: WIND, CURRENTS AND TEMPERATURE OVER THE CONTINENTAL SHELF AND SLOPE OFF PERU DURING JOINT 2, MARCH 1976 - MAY 1977
D. B. Enfield, R. L. Smith, and A. Huyer Apr. 1978 332 p refs
(Grant NSF OCE-76-00132)
(PB-287564/9; DATA-70; Ref-78-4; NSF/IDOE-78-104; NSF/IDOE/CUEA/DR-52) Avail: NTIS HC A15/MF A01 CSCL 08C

Oregon State University installed and recovered moorings along the coast of Peru during the period late March 1976 through mid-May 1977. A mid-shelf mooring near 15 degrees S (MILA) was maintained for the full duration of the experiment, through five successive installations. This site was complemented by six other moorings in the first half of 1976 and by nine in the March-April-May 1977 period. These simultaneous moorings were arranged in onshore-offshore arrays near 15 degrees S and in alongshore arrays at midshelf from 10 degrees to 15 deg 30 min S. The data described in this report consists of the hourly processed and filtered values of wind and current velocity, air and water temperature, and pressure from the 1976-1977 Peru installations. GRA

N79-15548# Massachusetts Inst. of Tech., Cambridge.
BOTTOM FRICTION UNDER WAVES IN THE PRESENCE OF A WEAK CURRENT
William Denny Grant and Ole Secher Madsen Aug. 1978 139 p refs
(Contract NOAA-03-6-022-35220)
(PB-287426/1; NOAA-78091902; NOAA-TM-ERL-MESA-29) Avail: NTIS HC A07/MF A01 CSCL 08C

A theoretical approach is adopted to study the combined motion of waves and currents in the presence of a rough bottom. By using a time-in-variant, turbulent eddy viscosity that increased linearly with height above the sea bed, the linearized governing equations are solved for both the wave motion and the current motion inside and outside the wave boundary layer. Inside the wave boundary layer, the current exhibits the expected logarithmic profile depending on the physical bottom roughness. The current velocity profile above the wave boundary layer is written in a logarithmic form. The dynamics of the wave-current interaction with the rough bottom are solved using the concept of a wave-current friction factor. Graphs are presented to facilitate the determination of the wave-current friction factor. GRA

N79-15549# Florida State Univ., Gainesville.
ARTIFICIAL REEFS IN FLORIDA: PROCEEDINGS OF A CONFERENCE
Donald Y. Aska May 1978 77 p Conf. held at the Univ. of South Florida, St. Petersburg, Bayboro Campus, 10-11 Jun. 1977 Prepared in cooperation with Coastal Plains Center for Marine Develop. Sys., Wash., D. C., Fla. State Dept. of Environ. Regulation, Tallahassee and Fla. Dept. of Natural Resources, Tallahassee
(Grant NOAA-04-7-158-44046)
(PB-287911/2; Florida-Sea-Grant-24; NOAA-78090703) Avail: NTIS HC A05/MF A01 CSCL 13B

The conference which was held at the University of South Florida in St. Petersburg, Florida on June 10 and 11, 1977, assessed the state-of-the-art, reviewed socioeconomic-biological impacts of reef construction, development and use, and identified areas where user-agency needs and services could better mesh. The general concepts of reef site selection and engineering, permitting procedures, the biological, social, economical and engineering aspects of reef operations and benefits, the broad range of users and compatability issued involved, the funding of reefs, and case studies of reefs not only in Florida but in adjoining states were discussed. GRA

N79-15550# Hawaii Inst. of Geophysics, Honolulu.
PRELIMINARY DUMAND SITE EVALUATION: MAUI BASIN AND KEAHOLE POINT BASIN
Robert R. Harvey, James E. Andrews, and J. Ronald Zaneveld Jun. 1978 52 p refs Prepared in cooperation with Oregon Sate Univ., Corvallis
(Contract N00014-67-A-0369; Grant NOAA-04-6-158-44114; NR Proj. 083-102)
(PB-286946/9; HIG-78-2; UNIHI-SEAGRANT-CR-78-02; NOAA-78082902) Avail: NTIS HC A04/MF A01 CSCL 08J

The proposed DUMAND project requires construction of a photomultiplier/hydrophone array comprising a cubic kilometer of seawater at 5 kilometers depth on the ocean bottom. Such an unprecedented scale of deep ocean engineering requires detailed knowledge of the environmental parameters which will affect the deployment, operation and maintenance of the system. The findings of a preliminary survey of geological, geophysical, water current and optical characteristics are described at the two proposed Hawaiian sites; Maui Basin and Keahole Point Basin. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N79-15551# Bureau of Radiological Health, Rockville, Md.
THE PHYSICAL BASIS OF ELECTROMAGNETIC INTERACTIONS WITH BIOLOGICAL SYSTEMS
Leonard S. Taylor, ed. (Maryland Univ., College Park) and Augustine Y. Cheung, ed. (Maryland Univ., College Park) Apr. 1978 403 p refs Workshop held at College Park, Md., 15-17 Jun. 1977; sponsored in part by ONR and Naval Med. Res. and Develop. Command
(HEW-Pub-FDA-78-8055) Avail: NTIS HC A18/MF A01

Microwave effects upon living organisms are studied by the biophysical aspects of electromagnetic field interactions with biological systems. For individual titles, see N79-15552 through N79-15569.

N79-15552# Virginia Commonwealth Univ., Richmond. Dept. of Biophysics.
SURVEY OF MICROWAVE AND RADIOFREQUENCY BIOLOGICAL EFFECTS AND MECHANISMS
S. F. Cleary *In* Bur. of Radiological Health The Phys. Basis of Electromagnetic Interactions with Biol. Systems Apr. 1978 p 1-33 refs (For primary document see N79-15551 06-51)
Avail: NTIS HC A18/MF A01

Representative works from the recent literature are reviewed to define the nature of the biological effects of microwave and radiofrequency exposure and the proposed basic physical interaction mechanisms. The results of studies of neuroendocrine alterations, hematopoietic effects, and effects on neural systems are considered. It is suggested that biomembranes may be the primary site for microwave and radiofrequency alterations, and that the most likely interaction mechanism appears to involve macromolecular ensembles stabilized by long-range systems of weak time-varying cooperative interactions. Author

N79-15553# Veterans Administration Hospital, Little Rock, Ark.
MOLECULAR ABSORPTION OF NON-IONIZING RADIATION IN BIOLOGICAL SYSTEMS
Karl David Straub *In* Bur. of Radiological Health The Phys. Basis of Electromagnetic Interactions with Biol. Systems Apr. 1978 p 35-42 refs Prepared in cooperation with Arkansas Univ. for Med. Sci., Little Rock (For primary document see N79-15551 06-51)
Avail: NTIS HC A18/MF A01

The absorption of EM radiation is determined by the bulk dielectric properties of living tissues, cells and biomolecules in solution. Among many possible examples the following five are given: (1) The network of membranous lipid-containing structures within and at the outside limit of cells poses a series of barriers to thermalization of the absorbed radiation; (2) subsequent temperature elevation may cause membrane structures or complex protein assemblies to pass through phase transitions, altering their properties; (3) spatial anisotrophy in the arrangement of large molecular assemblies results in specialized functions which can be completely changed if some of the molecules are rotated or translated by EM radiation; (4) quantum effects such as proton tunneling with resulting isomerization of DNA base pairs may also be influenced by EM radiation; and (5) otherwise random motion of gates in excitable channels of nerve membranes may be brought into forced oscillation by EM radiation, with resultant membrane depolarization. G.G.

N79-15554# Tufts Univ., Medford, Mass. Dept. of Chemistry.
MILLIMETER WAVE AND FAR INFRARED ABSORPTION IN BIOLOGICAL SYSTEMS
K. H. Illinger *In* Bur. of Radiological Health The Phys. Basis of Electromagnetic Interactions with Biol. Systems Apr. 1978 p 43-66 refs (For primary document see N79-15551 06-51)
Avail: NTIS HC A18/MF A01

The hierarchy of interactions of millimeter wave and far infrared radiation with biological systems is surveyed. The significance of existing experimental data and theory is summarized and problems and applications discussed. Author

N79-15555# California Univ., Los Angeles. Dept. of Anatomy and Brain Research Inst.
POSSIBLE MECHANISMS OF WEAK ELECTROMAGNETIC FIELD COUPLING IN BRAIN TISSUE c52
S. M. Bawin, A. Sheppard, and W. R. Adey *In* Bur. of Radiological Health The Phys. Basis of Electromagnetic Interactions with Biol. Systems Apr. 1978 p 75-90 refs Submitted for publication (For primary document see N79-15551 06-51)
(Contracts F44620-70-C-0017; N00014-A-200-4037; Grants FD-67801; NSF GB-27740)
Avail: NTIS HC A18/MF A01

Anionic binding sites on cell surface macromolecules were observed for a series of amplitude and frequency windows that strongly suggest resonant interactions based on long range order. ELF fields between 6 and 20 Hz reduced Ca-45(2+) efflux from chick and cat forebrain tissue by about 15%, with a maximum effect for fields in air at 10 and 56 V/m. Isolated chick cerebral tissue was also exposed to a 147 MHz field, 0.8 mW/2 cu cm and amplitude modulated at frequencies from 0.5 to 35 Hz. There was a frequency window for increased efflux (15%) at modulating frequencies from 9 to 20 Hz, and a window in incident field strength for increased Ca-45(2+) efflux only between 0.1 and 1.0 mW/cu cm. It is assumed that membrane surface charge sites behave coherently over a considerable area, and that a coherent patch may be triggered to change state by a very weak trigger at one point. G.G.

N79-15556# Pennsylvania Univ., Philadelphia. Dept. of Bioengineering.
CLASSICAL THEORY OF MICROWAVE INTERACTIONS WITH BIOLOGICAL SYSTEMS
H. P. Schwan *In* Bur. of Radiological Health The Phys. Basis of Electromagnetic Interactions with Biol. Systems Apr. 1978 p 91-112 refs (For primary document see N79-15551 06-51)
Avail: NTIS HC A18/MF A01

The established mechanisms responsible for the interaction of microwaves and other electrical fields with biological systems are surveyed. Foremost is the heat development which results from the absorption of microwaves. The relative contribution to this heat development caused by the various tissue constituents including ions, water, biopolymers, bound water and lipids are discussed. Direct field interactions with various biocomponents are also considered. These include membrane interactions, biopolymer interactions, interactions with biological fluids, and field-generated forces acting on biological particles and cells. These forces are frequently neglected in discussions and yet pertain to a large number of published observations. Author

N79-15557# Queen Elizabeth Coll., London (England). Dept. of Physics.
DETERMINATION OF BOUND WATER IN BIOLOGICAL MATERIALS FROM DIELECTRIC MEASUREMENTS
G. H. Grant *In* Bur. of Radiological Health The Phys. Basis of Electromagnetic Interactions with Biol. Systems Apr. 1978 p 113-120 refs (For primary document see N79-15551 06-51)
Avail: NTIS HC A18/MF A01

For aqueous biological materials variations in permittivity occurring between 100-1000 MHz are principally due to the water of hydration, and the hydration of such materials can be determined by measurement of the dielectric permittivity. Measurements of the static permittivity and the relaxation time can be used to predict the absorption of microwave energy by a hydrated biological macromolecule, based on a suitable model. Using a spherical shell model for the macromolecule and the experimentally determined permittivities and conductivities, the variation of specific energy absorption as a function of frequency was calculated. It is shown that in a certain frequency region the absorption is much greater for bound water than for free water. G.G.

N79-15558# Miami Univ., Coral Gables, Fla. Lab. for Quantitative Biology and Lab. for Water Research.
INTERFACIAL AND INTRACELLULAR WATER: EXPECTED ANOMALIES IN DIELECTRIC PROPERTIES
James S. Clegg and W. Drost-Hansen *In* Bur. of Radiological Health The Phys. Basis of Electromagnetic Interactions with Biol. Systems Apr. 1978 p 121-131 refs (For primary document see N79-15551 06-51)
(Grant NSF PCM-76-24037)
Avail: NTIS HC A18/MF A01

Evidence is provided that water adjacent to surfaces in inanimate systems differs markedly in its properties from ordinary

bulk water. Calculations of the amount of intracellular surface area (rat liver cells) strongly suggest that a large fraction of intracellular water should be so perturbed, by proximity to various ultrastructural surfaces. Such vicinal water plays an important role in the interactions of biological systems with electromagnetic radiation, particularly in the microwave region. G.G.

N79-15559# Purdue Univ., Lafayette, Ind. Dept. of Physics.
MICROWAVE FREQUENCIES AND THE STRUCTURE OF THE DOUBLE HELIX
E. W. Prohofsky *In* Bur. of Radiological Health The Phys. Basis of Electromagnetic Interactions with Biol. Systems Apr. 1978 p 133-144 refs (For primary document see N79-15551 06-51)
(Grant NSF DMR-74-14367)
Avail: NTIS HC A18/MF A01

The vibrational modes of homopolymer DNA double helices are calculated. These calculations were refined by comparison with IR and Raman observation from 1200 cm/1 to about 200 cm/1. The agreement is reasonably good. These calculations also indicate the existence of a number of bands within the microwave region of the spectrum. It is possible to use these calculations to predict absorption. Low lying vibrational modes are also of importance in predicting conformation, or shape changes in macromolecules. G.G.

N79-15560# Polytechnic Inst. of New York. Dept. of Electrical Engineering.
EVANESCENT WAVES AND WAVES IN ABSORBING MEDIA **c32**
Leopold Felsen *In* Bur. of Radiological Health The Phys. Basis of Electromagnetic Interactions with Biol. Systems Apr. 1978 p 149-163 Repr. from J. Opt. Soc. Am., v. 66, no. 8, 1976 p 751 (For primary document see N79-15551 06-51)
Avail: NTIS HC A18/MF A01

Recent developments in the treatment of high frequency evanescent waves are described. The method of evanescent wave tracking is discussed and the application of this technique to rays in lossy dielectrics is suggested. Author

N79-15561# Washington Univ., Seattle. Bioelectromagnetics Research Lab.
MICROWAVE AND RF DOSIMETRY **c52**
Chung-Kwang Chou and Arthur W. Guy *In* Bur. of Radiological Health The Phys. Basis of Electromagnetic Interactions with Biol. Systems Apr. 1978 p 165-216 refs (For primary document see N79-15551 06-51)
(Contract F41609-76-C-0032; Grants FD-00646; GM-05681; RSA-16-P-56818)
Avail: NTIS HC A18/MF A01

Factors which determine the microwave and RF power absorption in tissues are pointed out to emphasize the complexity of the microwave and RF dosimetry. Quantification of power absorption is, therefore, necessary for any meaningful research results. Current available instrumentations and techniques for measuring microwave and RF field intensity in air and specific absorption rates in tissues are summarized. Applications of dosimetric techniques in assessing power absorption in animals or human models and in establishing threshold for observed biologic effects are elaborated. Author

N79-15562# Maryland Univ., College Park. Inst. for Physical Science and Technology.
ELECTRIC FIELD MEASUREMENTS WITHIN BIOLOGICAL MEDIA
A. Y. Cheung *In* Bur. of Radiological Health The Phys. Basis of Electromagnetic Interactions with Biol. Systems Apr. 1978 p 217-242 refs (For primary document see N79-15551 06-51)
Avail: NTIS HC A18/MF A01

A miniature isotropic electric field probe for implantation electric field measurements within biological tissues is discussed. An analysis employing a transmission line model of a buried antenna as well as insulated dipoles was performed over the 0.9 to 10 GHz range. The antenna impedance modification due to interaction with the surrounding media was computed for a wide range of dielectric parameters typical of various biological materials, over a range of ambient temperatures. It was demonstrated analytically and experimentally that for deep implantation in muscle, very little change in probe response occurs with respect to the free space response of the probe over the frequency range of 0.915 GHz to 2.45 GHz. In very close proximity to the muscle-fat or even the muscle-air boundary, no observable change occurs in probe response due to dipole impedance variations. G.G.

N79-15563# Utah Univ., Salt Lake City. Dept. of Electrical Engineering and Bioengineering.
SOME RECENT RESULTS ON THE DEPOSITION OF ELECTROMAGNETIC ENERGY IN ANIMALS AND MODELS OF MAN **c52**
O. P. Gandhi and M. J. Hagmann *In* Bur. of Radiological Health The Phys. Basis of Electromagnetic Interactions with Biol. Systems Apr. 1978 p 243-259 refs (For primary document see N79-15551 06-51)
Avail: NTIS HC A18/MF A01

A realistic human model and improved numerical methods were used for calculating the deposition of electromagnetic energy. Both, the average absorption and the distribution of absorbed energy within the model, are in good agreement with experimental measurements made using phantom models. The distribution of absorbed energy is frequency-dependent and may be explained in terms of resonance of the various body parts. Numerical solutions for man near a ground plane and near reflectors are presented for the first time. At 10 MHz the specific absorption rate (SAR) of man standing on a ground plane is about seven times that for man in free space. Multibody effects were predicted from antenna theory and observed with experiments using anesthetized rats. For two resonant targets separated by 0.65 lambda an increased SAR, 170 percent of the free-space value, was observed. G.G.

N79-15564# Arizona Univ., Tucson. Radiation Oncology Div.
THERMOMETRY IN STRONG ELECTROMAGNETIC FIELDS **c35**
T. C. Cetas *In* Bur. of Radiological Health The Phys. Basis of Electromagnetic Interactions with Biol. Systems Apr. 1978 p 261-281 refs (For primary document see N79-15551 06-51)
(Contract FDA-221-76-0189; Grants CA-17343; FD-03189-76)
Avail: NTIS HC A18/MF A01

Several new developments are reported in thermometry designed to meet the need for measurements in the presence of strong electromagnetic fields. The requirements for calibration facilities for probe thermometers and for thermographic systems are also described. G.G.

N79-15565# Office National d'Etudes et de Recherches Aerospatiales, Toulouse (France). Microwave Dept.
NON-PERTURBING MICROPROBES FOR MEASUREMENTS IN ELECTROMAGNETIC FIELDS **c35**
A. Deficis and A. Priou *In* Bur. of Radiological Health The Phys. Basis of Electromagnetic Interactions with Biol. Systems Apr. 1978 p 283-293 refs (For primary document see N79-15551 06-51)
Avail: NTIS HC A18/MF A01

A new generation of non-interfering microprobes is under development. It consists of dielectric microthermometers, named the M.T.D. probes; their specific temperature range cover -40 C to +150 C in several steps. The introduced perturbation is very low, less than 0.1 db whatever the frequency range. The M.T.D. probe's medical and industrial applications are widespread and significant. Author

N79-15566# Illinois Univ., Urbana-Champaign.
THE VISCOMETRIC THERMOMETER **c35**
Charles A. Cain, Michael M. Chen, Katherine Loh Lam, and Jeffrey Mullin *In* Bur. of Radiological Health The Phys. Basis of Electromagnetic Interactions with Biol. Systems Apr. 1978 p 295-308 refs (For primary document see N79-15551 06-51)
Avail: NTIS HC A18/MF A01

The instrument is based on the variation of fluid viscosity with temperature. The sensing element is simply a flow restriction at the end of the probe containing fluid supply and return lumens. A suitable fluid is pumped through the system at sufficiently low speed that the temperature of the fluid at the sensing tip is in equilibrium with the surrounding media, and the fluid flow

is in the viscous (Stoke's flow) regime. If the sensing capillary represents the dominant flow restriction, the pressure difference for a given flow rate is directly proportional to the fluid viscosity at the probe tip and can be calibrated in temperature. Since the viscosity of many fluids is highly temperature dependent, a wide variety of fluids can be used. G.G.

N79-15567# Massachusetts Inst. of Tech., Cambridge. Dept. of Physics and Research Lab. of Electronics.
MICROWAVE THERMOGRAPHY: PHYSICAL PRINCIPLES AND DIAGNOSTIC APPLICATIONS c52
Philip C. Myers and Alan H. Barrett *In* Bur. of Radiological Health The Phys. Basis of Electromagnetic Interactions with Biol. Systems Apr. 1978 p 309-325 refs (For primary document see N79-15551 06-51)
(Grant GM-20370-04)
Avail: NTIS HC A18/MF A01

The application of microwave radiometry to the mapping of microwave emission from human tissue is detailed. The relative transparency of human tissue at microwave frequencies permits sensing of the average temperature within a volume, extending to depths of one to five cm, depending on frequency and tissue type. Receiver temperature sensitivity is of order 0.1 C. Lateral resolution is of order 1 cu cm, and depends on depth, frequency, and antenna aperture size. Frequency-dependent tradeoffs exist between lateral resolution and depth resolution, and between temperature sensitivity and depth resolution. Potential applications in diagnostic medicine include detection of cancerous tumors, peripheral vascular disease, incipient strokes, and local inflammations. Clinical trials of application to breast cancer detection indicate true-positive and true-negative rates of about 70%, which are comparable to the rates for infrared thermography. G.G.

N79-15568# Bureau of Radiological Health, Rockville, Md.
DESIGN AND STANDARDIZATION OF EXPOSURE SYSTEMS FOR RF AND MICROWAVE EXPERIMENTATION c35
Mays L. Swicord and Henry S. Ho *In its* The Phys. Basis of Electromagnetic Interactions with Biol. Systems Apr. 1978 p 327-358 refs (For primary document see N79-15551 06-51)
Avail: NTIS HC A18/MF A01

Currently used microwave and RF animal and cellular exposure systems include anechoic chambers, parallel plate transmission lines, Crawford cells, and waveguide systems for whole body exposure. Exposure systems utilizing waveguide or coaxial lines to expose cell cultures, and systems designed for selective or partial body exposure are also discussed. G.G.

N79-15569# Bureau of Radiological Health, Rockville, Md.
CALIBRATION TECHNIQUES FOR MICROWAVE AND RF EXPOSURE MEASUREMENT DEVICES c35
Howard I. Bassen *In its* The Phys. Basis of Electromagnetic Interactions with Biol. Systems Apr. 1978 p 359-382 refs (For primary document see N79-15551 06-51)
Avail: NTIS HC A18/MF A01

One technique, most suitable above 500 MHz, involves the use of an anechoic chamber and a waveguide horn antenna whose gain is precisely calibrated under far-field conditions. Special measures were taken to eliminate artifacts from various multipath reflections which exist in the anechoic chamber. A complementary technique was employed below 500 MHz to calibrate isotropic hazard probes. It involved the use of a rectangular TEM transmission line cell. In addition to providing accurate calibrated field strengths from dc to 500 MHz, these cells require only a moderate amount of RF power to generate fields of sufficient strength to calibrate hazard probes over their intended range of operation. The evaluation of probe performance with respect to temperature, antenna pattern, field modulation, and other parameters is discussed. Radiofrequency interference in the probe's output cable and readout instrumentation package is analyzed as a significant source of error. G.G.

N79-15570# Rosenstiel School of Marine and Atmospheric Sciences, Miami, Fla. Div. of Biology and Living Resources.
NITROGEN FIXATION WITH PHOTOSYNTHETIC MARINE MICROORGANISMS Progress Report, 15 Feb. - 30 Dec. 1977
Akira Mitsui Dec. 1977 27 p
(Grants NSF AER-76-17159; NSF PFR-76-17159)
(PB-286000/5; NSF/RA-770642) Avail: NTIS HC A03/MF A01 CSCL 02C

Research into the marine environment to find and develop photosynthetic, nitrogen fixing processes capable of providing food and/or fertilizer without the expenditure of non-renewable resources is reported. A great number of pure strains of nitrogen fixing algae were established. Feeding experiments using an aquaculture species of shrimp and food value analysis of blue-green algae, were begun, as was a detailed study of acetylene reduction characteristics of certain fast-growing strains. Growth and mortality ratios under differing concentrations of algae were also being examined. GRA

N79-15571# California Univ., Davis.
ENHANCING BIOLOGICAL PRODUCTION OF AMMONIA FROM ATMOSPHERIC NITROGEN AND SOIL NITRATE Annual Report
James M. Lyons Jun. 1978 69 p refs
(Grant NSF AER-77-07301)
(PB-286515/2; NSF/RA-780161) Avail: NTIS HC A04/MF A01 CSCL 02A

Five significant contributions to an understanding of the genetic control of N2 fixation and photosynthesis are reported: (1) an estimate of the energy cost to Rhizobium for fixing N2 obtained by using genetically altered free-living cultures of N2-fixing bacteria; (2) the first report of regulation of an enzyme system (hydrogenase) which takes up H2 in free-living, N2-fixing Rhizobium; (3) the first report of catalytic mutants in ribulose bisphosphate carboxylase, the primary enzyme responsible for photosynthetic CO2 reduction; (4) the first report of a soybean plant which continues to photosynthesize and to fix N2 during and after seed pod development; and (5) the first report of genetically altering the host specificity of Rhizobium bacteria. GRA

N79-15572# Vermont Univ., Burlington. Water Resources Research Center.
DETERMINATION OF THE SECONDARY PRODUCTION AND POPULATION DYNAMICS OF THE ZOOPLANKTON OF THE LAKE CHAMPLAIN ECOSYSTEM Final Report, Jul. 1976 - Sep. 1977
Robert Keen (Mich. Tech. Univ., Houghton) and Milton Potash Jun. 1978 80 p refs
(Contract DI-14-34-0001-7096; OWRT Proj. A-028-VT(1))
(PB-286094/8; W78-11376) Avail: NTIS HC A05/MF A01 CSCL 08H

The main basin of the lake was sampled intensely July 1976-August 1977. Four other different water masses of the lake were sampled less intensely to provide a picture of the zooplankton of the whole lake. In general, the species present in the main lake were characteristics of deep, oligotrophic lakes. Population densities were maximal in the summer months at about 17,000 per cubic meter, and lower than this in the spring and fall. Series of samples to study daily vertical migration showed copepods and Mysis to be following the classic pattern. Daphnia did not show a strong migration. The two species of Bosmina were separated vertically in the water column. GRA

N79-15573# Environmental Monitoring and Support Lab., Las Vegas, Nev.
DISTRIBUTION OF PHYTOPLANKTON IN NORTH CAROLINA LAKES Progress Report, 7 Mar. - 14 Nov. 1973
M. K. Morris, L. R. Williams, W. S. Taylor, F. A. Hiatt, and S. C. Hern May 1978 81 p refs Prepared in cooperation with Nevada Univ., Las Vegas
(PB-286387/6; EPA-600/3-78-051) Avail: NTIS HC A05/MF A01 CSCL 08H

A data report is given presenting the species and abundance of phytoplankton in the 16 lakes sampled by the National Eutrophication Survey in the state of North Carolina. Results from the calculation of several water quality indices are also included (Nygaard's Trophic State Index, Palmer's Organic Index, and species diversity and abundance indices). The collection and analysis of phytoplankton data were included in the Survey in an effort to determine relationships between algal characteristics and trophic status of individual lakes. GRA

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N79-15574* National Aeronautics and Space Administration, Washington, D. C.

AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 188, JANUARY 1979

Jan. 1979 77 p

(NASA-SP-7011(188)) Avail: NTIS HC E02 CSCL 06E

This bibliography lists 230 reports, articles, and other documents introduced into the NASA scientific and technical information system in December 1978. Author

N79-15575# Western Kentucky Univ., Bowling Green. Biophysics Lab.

WAVELENGTH DEPENDENCE OF ULTRAVIOLET-ENHANCED REACTIVATION AND INDUCTION OF MAMMALIAN VIRUSES

Thomas P. Coohill Mar. 1978 28 p refs Sponsored in part by WHO

(Contract FDA-223-74-6067)

(HEW-PUB-FDA-78-8059) Avail: NTIS HC A03/MF A01

It was determined that radiation of wavelength 260 nm is the most effective in reducing the ability (capacity) of a mammalian cell (CV-1) to support the growth of the virus herpes simplex. An action spectrum for this effect in the ultraviolet (UV) radiation range 235 nm to 302 nm closely resembles the absorption spectrum for nucleic acid. These data point to DNA as the target molecule for UV radiation effects on cellular capacity. An action spectrum was also completed for radiation-enhanced reactivity over a similar wavelength region in the same system. Data on the radiation of simian virus 40 from transformed BHK cells are presented. Radiation of wavelength 260 nm or 280 nm is more effective in activating this virus than radiation of wavelengths 240 nm and 297 nm. These first results indicate that nucleic acid and/or proteins are the major macromolecules involved in this effect. Author

N79-15576*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

IMPROVED SUBCUTANEOUS ELECTRODE STRUCTURE Patent Application

Gordon F. Lund, inventor (to NASA) (NAC-NRC) Filed 16 Jan. 1979 16 p Sponsored by NASA

(NASA-Case-ARC-11117-1; US-Patent-Appl-SN-003693) Avail: NTIS HC A02/MF A01 CSCL 06B

The invention relates in general to a subcutaneous electrode structure useful as a chronic implant for taking electrocardiograms of active animals. The electrode comprises a thin inflexible, smooth disc of stainless steel having a diameter as of 5 to 30 millimeters which is sutured in place to the tissue of the animal being monitored by means of a plurality of sutures passing through suture holes in the periphery of the disc. An electrical connection is made to the disc by means of a flexible lead wire that extends longitudinally of radially directed slot in the disc and held there at the terminal end by means of a spotwelded tab. An electrically insulative sleeve, such as silicon rubber, is placed over the wire. The wire with the sleeve is captured in the plane of the disc and within the slot by means of crimping tabs extending laterally across the slot and over the insulated wire. NASA

N79-15577# Civil Aeromedical Inst., Oklahoma City, Okla.

ASSESSMENT OF FACTORS POSSIBLY CONTRIBUTING TO THE SUSCEPTIBILITY OF SICKLE TRAIT ERYTHROCYTES TO MILD HYPOXIA. VOLUME 1: DESIGN CONSIDERATIONS AND RESEARCH PROTOCOL

Jess M. McKenzie Aug. 1978 10 p refs

(AD-A059412; FAA-AM-78-30-Vol-1) Avail: NTIS HC A02/MF A01 CSCL 06/5

The evidence for mixed dominance of the Hbs(beta) gene in people with the sickle cell trait is studied. These individuals, whose erythrocytes contain a mixture of hemoglobins (HbA/HbS), are healthy and have a normal life expectancy. They are tolerant to moderate altitudes; their erythrocytes become sickled only at oxygen tensions that are hazardous to any person. However, there is a possibility that other debilitating factors (e.g., alcoholism, pulmonary disorders) can produce an abnormal susceptibility to hypoxia. Those so debilitated are not medically qualified to serve as aircrew members. An experimental plan is outlined for estimating the proportion of such individuals in a population of young people with the sickle trait. G.G.

N79-15578# Royal Aircraft Establishment, Farnborough (England).

THE INFLUENCE OF MECHANICAL VIBRATION AND NOISE ON THE PERIPHERAL BLOOD CIRCULATION AT SKIN LEVEL

H. Dupuis and A. Weichenrieder Jun. 1978 12 p refs Transl. into ENGLISH of conf. paper from Max-Planck-Inst. fuer Landarbeit und Landtechnik, Bad Kreuznach, West Germany Presented at the 17th Ann. Conf. of the Deut. Ges. fuer Arbeitsmed. e. V., Kiel, 5-7 May 1977

(RAE-Lib-Trans-1980; BR66064) Avail: NTIS HC A02/MF A01

Ten male test subjects (average age 24.9 years) were subjected to fifteen test variations in a vibration and noise simulator under laboratory conditions. These variations consisted of a test at rest (null test), a noise test (100 db(A) of white noise), a static test (grip and pressure from the right hand to produce 25 N), eight vibration tests (various frequencies, accelerations and arm positions) with static applications of grip and pressure to produce 25 N, and four combined noise and vibration tests (100 db(A) and vibratory stress at various frequencies). The results show that vascular constrictions are a more noticeable effect of noise, but static hand force and mechanical vibrations mainly will cause a drop in skin temperature. Even a short period of time, these forms of stress can lead to peripheral vegetative incapacities. G.Y.

N79-15579# Monsanto Research Corp., Dayton, Ohio.

PHYSICAL TESTING OF POLYMERS USE IN CIRCULATORY ASSIST DEVICES Annual Report, 1 Sep. 1977 - 31 May 1978

Carl R. McMillin Jun. 1978 77 p refs

(Contract N01-HV-7-2918)

(PB-286129/2; MRC-DA-787; AR-1) Avail: NTIS HC A05/MF A01 CSCL 06L

Two lots of polyhexene rubber were received. It was found that this material is slightly crystalline with a crystalline melting point of 49C. The differential scanning calorimeter shows that as the samples were heated from a low temperature, they began to crystallize around room temperature reaching a maximum rate of crystallization just below its melting point of 49C. When the Goodyear polyhexene rubber, with its carbon black filler, is strained in (250%) a cyclic manner, the elastic modulus of the second cycle is about 20% of the first cycle modulus. GRA

N79-15580# Office of Technology Assessment, Washington, D. C.

ASSESSING THE EFFICACY AND SAFETY OF MEDICAL TECHNOLOGIES

Sep. 1978 135 p refs

(PB-286929/5; OTA-H-75; LC-78-600117) Avail: NTIS HC A07/MF A01 CSCL 06E

Opportunities for assessment focused on the societal impacts of medical technologies. Policy implications of the computed tomography scanner examined the development, diffusion, use, and reimbursement of CT scanners. The importance and current status of information on efficacy and safety as well as techniques and programs for generating that information are developed. GRA

N79-15581# Mayo Foundation, Rochester, Minn.

DEVELOPMENT OF HIGH-RESOLUTION ULTRASONIC IMAGING TECHNIQUES FOR DETECTION AND CLINICAL ASSESSMENT OF CARDIOVASCULAR DISEASE Annual Report, Sep. 1977 - 30 Jun. 1978

Titus C. Evans, Jr., Philip S. Green, James F. Greenleaf, and S. David Ramsey, Jr. Jun. 1978 46 p Prepared in cooperation with SRI Intern., Menlo Park, Calif.

(Contract N01-HV-7-2928-1)

(PB-286696/0; NIH/NHLBI-N01/HV-7-2928-1) Avail: NTIS

HC A03/MF A01 CSCL 06B

Ultrasound instrumentation and methods for the detection and assessment of atherosclerosis in carotid and femoral arteries of living patients, thereby avoiding the pain, risk, and associated drawbacks of angiography were developed and tested. Testing of equipment and methods involved laboratory and clinical studies. A comparison with double-blind, lesion-by-lesion analysis was found to be necessary and is in progress. Significant improvement in the ease of using the clinical instrument, in B-scan resolution, and in the signal-to-noise ratio of the Doppler system were achieved. Digital signal processing is being prepared for use in signal analysis and interpretation. Improved B-scan and Doppler electronics are being developed. GRA

N79-15582# Cincinnati Univ., Ohio. Coll. of Medicine.
DEVELOPMENT AND EVALUATION OF INSTRUMENT SYSTEMS FOR NONINVASIVE DETECTION, CHARACTERIZATION AND QUANTIFICATION OF ATHEROSCLEROTIC LESIONS Annual Report, 2 Sep. 1977 - 15 Jun. 1978
C. P. Olinger, A. K. Nigam, J. F. Wasserman, and J. VanderBel-Kahn 15 Jun. 1978 54 p refs Prepared in cooperation with Horizons Res. Labs., Inc., Ft. Lauderdale, Fla.
(Contract N01-HV-7-2924)
(PB-286851/1; NIH-N01-7-2924-1) Avail: NTIS HC A04/MF A01 CSCL 06E

Advanced noninvasive pulse-echo ultrasound techniques were studied for detecting the presence, the extent and the nature of atherosclerosis in living patients. A high resolution, large dynamic range, real-time ultrasound imaging equipment was built and iteratively modified to provide the optimum in-vivo plaque images. The equipment is also interfaced with ancillary devices capable of general purpose off-line computational analysis for the characterization of the plaque from the echo data. Angiographic-pathologic techniques have also been refined to permit a 1-to-1 correlation with the ultrasound imaging and characterization results. Both symptomatic and asymptomatic patients were examined and a total of over 200 cases documented. GRA

N79-15555# California Univ., Los Angeles. Dept. of Anatomy and Brain Research Inst.
POSSIBLE MECHANISMS OF WEAK ELECTROMAGNETIC FIELD COUPLING IN BRAIN TISSUE
S. M. Bawin, A. Sheppard, and W. R. Adey *In* Bur. of Radiological Health The Phys. Basis of Electromagnetic Interactions with Biol. Systems Apr. 1978 p 75-90 refs Submitted for publication (For primary document see N79-15551 06-51)
(Contracts F44620-70-C-0017; N00014-A-200-4037; Grants FD-67801; NSF GB-27740)
Avail: NTIS HC A18/MF A01

N79-15561# Washington Univ., Seattle. Bioelectromagnetics Research Lab.
MICROWAVE AND RF DOSIMETRY
Chung-Kwang Chou and Arthur W. Guy *In* Bur. of Radiological Health The Phys. Basis of Electromagnetic Interactions with Biol. Systems Apr. 1978 p 165-216 refs (For primary document see N79-15551 06-51)
(Contract F41609-76-C-0032; Grants FD-00646; GM-05681; RSA-16-P-56818)
Avail: NTIS HC A18/MF A01

N79-15563# Utah Univ., Salt Lake City. Dept. of Electrical Engineering and Bioengineering.
SOME RECENT RESULTS ON THE DEPOSITION OF ELECTROMAGNETIC ENERGY IN ANIMALS AND MODELS OF MAN
O. P. Gandhi and M. J. Hagmann *In* Bur. of Radiological Health The Phys. Basis of Electromagnetic Interactions with Biol. Systems Apr. 1978 p 243-259 refs (For primary document see N79-15551 06-51)
Avail: NTIS HC A18/MF A01

N79-15567# Massachusetts Inst. of Tech., Cambridge. Dept. of Physics and Research Lab. of Electronics.
MICROWAVE THERMOGRAPHY: PHYSICAL PRINCIPLES AND DIAGNOSTIC APPLICATIONS
Philip C. Myers and Alan H. Barrett *In* Bur. of Radiological Health The Phys. Basis of Electromagnetic Interactions with Biol. Systems Apr. 1978 p 309-325 refs (For primary document see N79-15551 06-51)
(Grant GM-20370-04)
Avail: NTIS HC A18/MF A01

N79-15890*# Institutes for the Achievement of Human Potential, Philadelphia, Pa. Inst. for Clinical Investigation.
THE CHILD IN COMA
Edward B. LeWinn *In* NASA. Ames Res. Center Human Neurol. Develop. Nov. 1978 p 17-19 (For primary document see N79-15887 06-99)
Avail: NTIS HC A04/MF A01 CSCL 06E

N79-15891*# Nassau Hospital, Mineola, N. Y. Coma Recovery Inst.
COMA RECOVERY
Mihai D. Dimancescu *In* NASA. Ames Res. Center Human Neurol. Develop. Nov. 1978 p 21-23 (For primary document see N79-15887 06-99)
Avail: NTIS HC A04/MF A01 CSCL 06E

N79-15892*# Institutes for the Achievement of Human Potential, Philadelphia, Pa. Inst. for Clinical Investigation.
THE CONTROL AND PREVENTION OF SEIZURES IN CHILDREN, A DEVELOPMENTAL AND ENVIRONMENTAL APPROACH
Edward B. LeWinn *In* NASA. Ames Res. Center Human Neurol. Develop. Nov. 1978 p 25-27 ref (For primary document see N79-15887 06-99)
Avail: NTIS HC A04/MF A01 CSCL 06E

N79-15893*# San Jose State Univ., Calif.
VESTIBULAR INFLUENCES ON OTHER SENSORY AND MOTOR PROCESSES
Brant Clark *In* NASA. Ames Res. Center Human Neurol. Develop. Nov. 1978 p 29-33 (For primary document see N79-15887 06-99)
Avail: NTIS HC A04/MF A01 CSCL 06P

N79-15894*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
VISION
Richard F. Haines *In its* Human Neurol. Develop. Nov. 1978 p 35-45 Original contains color illustrations (For primary document see N79-15887 06-99)
Avail: NTIS HC A04/MF A01 CSCL 06P

N79-15895*# Linus Pauling Inst. for Science and Medicine, Menlo Park, Calif.
ORTHOMOLECULAR ENHANCEMENT OF HUMAN DEVELOPMENT
Linus Pauling *In* NASA. Ames Res. Center Human Neurol. Develop. Nov. 1978 p 47-51 (For primary document see N79-15887 06-99)
Avail: NTIS HC A04/MF A01 CSCL 06P

N79-15897*# Trans World Airlines, Inc., Kansas City, Mo.
DEVELOPMENT OPPORTUNITIES IN THE SPACE ENVIRONMENT
Richard D. Norton *In* NASA. Ames Res. Center Human Neurol. Develop. Nov. 1978 p 59-63 (For primary document see N79-15887 06-99)
Avail: NTIS HC A04/MF A01 CSCL 06P

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N79-15583# National Aviation Facilities Experimental Center, Atlantic City, N. J.
RNAV PROCEDURAL TURN ANTICIPATION TECHNIQUES EXPERIMENT NO. 2, GAT-2A. PHASE 3: 2 AND 4 NMI OFFSET TRACKING PROCEDURES Interim Report, Jul. -

Sep. 1977
Bernard Goldberg and Donald Eldredge Sep. 1978 75 p
(FAA Proj. 044-326-340)
(AD-A060501; FAA-NA-78-34; FAA-RD-78-110) Avail: NTIS HC A04/MF A01 CSCL 05/9

The last of a series of interim and data reports dealing with offsets and turn anticipation techniques using a single waypoint analog RNAV (area navigation) system and a noncentered needle CDI (course deviation indicator) instrument is reported. Eight instrument rated pilots participated in a series of flight simulation tests employing pilot techniques which were conducted in order to measure total systems crosstrack (TSCT) and flight technical error (FTE) as well as operational pilot performance. The tests were designed to assess pilot performance for: (1) anticipation of turns while maintaining a desired offset, and (2) steady state parallel offset tracking proficiency. Performance was measured on these variables: horizontal tracking, airspeed control, and procedural performance. G.Y.

N79-15584# Navy Personnel Research and Development Center, San Diego, Calif.
RELATING PERFORMANCE IN BASIC ELECTRICITY AND ELECTRONICS AND A SCHOOLS Technical Report, Jun. 1976 - May 1977
Jane Sachar, Macy L. Abrams, and Christine Buckley Oct. 1978 62 p refs
(ZF5522002)
(AD-A060914; NPRDC-TR-79-2) Avail: NTIS HC A04/MF A01 CSCL 05/9

Relationships found between BE/E and 'A' school performance were used: (1) to determine the feasibility of applying lower mastery standards for different ratings without significantly affecting follow-on school success; and (2) to develop criteria for reassigning a student early to a class 'A' school on the basis of his early BE/E performance. Few differences were found on BE/E modules between successful and failing class 'A' school students. Reassigning students to alternative class 'A' schools using the models in this study were not very accurate in predicting performance and less so in predicting attrition. It was recommended that students be permitted through BE/E with lower mastery standards on an experimental basis and that some students omit BE/E entirely to determine whether and to what extent BE/E is a prerequisite to the follow-on school.
Author (GRA)

N79-15585# Naval Aerospace Medical Inst., Pensacola, Fla.
HUMAN PERFORMANCE IN CONCURRENT VERBAL AND TRACKING TASKS: A REVIEW OF THE LITERATURE Interim Report, 1967 - 1977
Steven D. Harris Jul. 1978 13 p refs
(ZF51524004)
(AD-A060493; NAMRL-SR-78-2) Avail: NTIS HC A02/MF A01 CSCL 05/10

The development of voice interactive computer systems (VIS) for the control of on-board aircraft systems is expected to result in reduced operator work-load and increased effectiveness of naval aviation crews. A data base is needed to provide answers to human factors engineering questions arising from this development. The research reported in sixteen major scientific journals, as well as in Psychological Abstracts, for the interval 1967-1977 inclusive, was examined for reports of investigations of human performance in concurrent verbal and continuous manual control tasks. A few readily available technical reports were also examined. Adequate experimental data are not available to form a data base to support human factors requirements of the VIS development. A comprehensive research program is needed to determine the extent of human operator performance capabilities in timeshared verbal and manual control tasks.
Author (GRA)

N79-15586# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
THE BEHAVIOR OF OBSERVERS IN DETECTING UNBRIEFED TARGETS AT DIFFERENT AIRCRAFT SPEEDS WITH SIDE-LOOKING RADAR Technical Report, 10 Nov. 1964 - 10 Nov. 1977
Herschel C. Self Jun. 1978 103 p refs
(AD-A060908; AMRL-TR-77-95) Avail: NTIS HC A06/MF A01 CSCL 05/9

The numerous false positives found in SLR studies with unbriefed targets pose a severe problem for operational systems. The present study examines this problem and derives mathematical equations for describing observer behavior. Twenty USAF Radar Observers were trained and tested on side-looking radar. They searched for unbriefed airfields, industrial sites, railroad yards and tank farms at simulated aircraft speeds of 700-2110 knots. A data camera photographed every object on the display designated as a target. Tripling aircraft speed reduced target detections by only 17% while reducing reaction time by 56%. The high percentage of false positives was found to be due to the similarity of the radar signatures of targets and non-target objects. The false positive problem was shown to not be solvable by: (1) Better selection and/or training of observers, (2) Use of the expressed confidence in response correctness of observers, or (3) Use of teams of independently-working observers. The relationships between measures of performance were examined in detail. Selection of superior observers was found to be complicated by the conflicting behavioral requirements of different performance measures. Author (GRA)

N79-15587# Massachusetts Inst. of Tech., Cambridge. Dept. of Psychology.
EXPERIMENTS IN TEXTURE PERCEPTION Final Report
Whitman A. Richards Jan. 1978 121 p refs
(Contract F44620-74-C-0076; ARPA Order 2765)
(AD-A059630; AFOSR-78-1165TR) Avail: NTIS HC A06/MF A01 CSCL 06/16

The human visual system appears to process spatial frequency information by filtering operations similar to that performed in color vision. In the more general case, textures will have luminance distributions varying in two dimensions (i.e. in both X and Y). If a two-dimensional texture is created with orthogonal luminance profiles (whereby the axis orientations of X and Y are 90 degrees apart), then the X and Y profiles are independent and four spatial frequencies will be needed for X and four for Y. The most general case of texture equivalence, where many orientations are present in a texture, has not yet been solved. Preliminary experiments show that orientation equivalence can be attained by utilizing only four independent orientations. This constraint suggests an upper bound of sixteen on the number of fixed spatial frequencies required to create an equivalence to any two-dimensional texture pattern. These limitations of human visual processing suggest that data transmission rates of textural information can be greatly compressed. G.G.

N79-15896*# Institutes for the Achievement of Human Potential, Philadelphia, Pa.
INTELLIGENCE
Glenn Doman, Janet Doman, Susan Aisen, Miki Nakayachi, Gail Engebretson, Conceicao DeSousa, and Bruce Hagy *In* NASA. Ames Res. Center Human Neurol. Develop. Nov. 1978 p 53-58
(For primary document see N79-15887 06-99)
Avail: NTIS HC A04/MF A01 CSCL 05J

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N79-15588*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE 14TH ANNUAL CONFERENCE ON MANUAL CONTROL
Nov. 1978 692 p refs Conf. held at Univ. of Southern Calif., Los Angeles, 25-27 Apr. 1978
(NASA-CP-2060; A-7615) Avail: NTIS HC A99/MF A01 CSCL 05H

Human operator dynamics during actual manual control or while monitoring the automatic control systems involved in air-to-air tracking, automobile driving, the operator of undersea vehicles, and remote handling are examined. Optimal control models and the use of mathematical theory in representing man

behavior in complex man machine system tasks are discussed with emphasis on eye/head tracking and scanning; perception and attention allocation; decision making; and motion simulation and effects. For individual titles, see N79-15589 through N79-15634.

N79-15589*# Illinois Univ. at Chicago Circle, Chicago. Coll. of Engineering.

DIRECTIONAL ERRORS OF MOVEMENTS AND THEIR CORRECTION IN A DISCRETE TRACKING TASK

Robert J. Jaeger, Gyan C. Agarwal, and Gerald L. Gottlieb *In* NASA. Ames Res. Center The 14th Ann. Conf. on Manual Control Nov. 1978 p 3-18 refs Prepared in cooperation with Rush Med. Center, Chicago (For primary document see N79-15588 06-54)

(Grants NSF ENG-76-08754; NS-00196; NS-12877; AA-02156)

Avail: NTIS HC A99/MF A01 CSCL 05H

Subjects can correct their own errors of movement more quickly than they can react to external stimuli by using three general categories of feedback: (1) knowledge of results, primarily visually mediated; (2) proprioceptive or kinaesthetic such as from muscle spindles and joint receptors, and (3) corollary discharge or efference copy within the central nervous system. The effects of these feedbacks on simple reaction time, choice reaction time, and error correction time were studied in four normal human subjects. The movement used was plantarflexion and dorsiflexion of the ankle joint. The feedback loops were modified, by changing the sign of the visual display to alter the subject's perception of results, and by applying vibration at 100 Hz simultaneously to both the agonist and antagonist muscles of the ankle joint. The central processing was interfered with when the subjects were given moderate doses of alcohol (blood alcohol concentration levels of up to 0.07%). Vibration and alcohol increase both the simple and choice reaction times but not the error correction time. A.R.H.

N79-15590*# Tokyo Univ. (Japan). Dept. of Aeronautics.

A STUDY OF THE EFFECT OF FORCING FUNCTION CHARACTERISTICS ON HUMAN OPERATOR DYNAMICS IN MANUAL CONTROL

Kyuichiro Washizu, Keiji Tanaka, and Tatsuo Osawa *In* NASA. Ames Res. Center The 14th Ann. Conf. on Manual Control Nov. 1978 p 19-32 refs Prepared in cooperation with Natl. Aerospace Lab., Tokyo (For primary document see N79-15588 06-54)

Avail: NTIS HC A99/MF A01 CSCL 05H

The effect of the spectrum of the forcing function on the human pilot dynamics in manual control was investigated. A simple compensatory tracking experiment was conducted, where the controlled element was of a second-order dynamics and the forcing function was a random noise having a dominant frequency. The dominant frequency and the power of the forcing function were two variable parameters during the experiment. The results show that the human pilot describing functions are dependent not only on the dynamics of the controlled element, but also on the characteristics of the forcing function. This suggests that the human pilot behavior should be expressed by the transfer function taking into consideration his ability to sense and predict the forcing function. A.R.H.

N79-15591*# California Univ., Berkeley. Dept. of Mechanical Engineering.

AN EXTENSION OF THE QUICKENED DISPLAY FOR MANUAL CONTROL

Masayoshi Tomizuka and Wai Ming Tam *In* NASA. Ames Res. Center The 14th Ann. Conf. on Manual Control Nov. 1978 p 33-43 refs (For primary document see N79-15588 06-54)

Avail: NTIS HC A99/MF A01 CSCL 05H

It is very difficult (or even impossible) for a human to control plants of third order or more with little or no damping by just knowing the instantaneous error. It has been shown that adding first and/or higher order derivatives to the error signal and displaying the combined signal are effective in facilitating human control over such plants. This signal quickening technique by Birmingham and Taylor is further extended to incorporate the future trajectory variation into the displayed signal so as to minimize the tracking error. A method for tuning free parameters in ordinary and extended quickening is established by applying discrete-time optimal control. Experimental results for a triple integrator plant indicate the effectiveness of the proposed method to achieve high quality tracking. A.R.H.

N79-15592*# Connecticut Univ., Storrs. Dept. of Electrical Engineering and Computer Science.

EFFECTS OF UNCERTAINTY ON MANUAL TRACKING PERFORMANCE

Arye R. Ephrath and Barbara Chernoff *In* NASA. Ames Res. Center The 14th Ann. Conf. on Manual Control Nov. 1978 p 45-53 refs (For primary document see N79-15588 06-54)

Avail: NTIS HC A99/MF A01 CSCL 05H

Transient phenomena and target acquisition modes associated with interrupted observations during ground-to-air AA tracking were investigated. Using a two-axes control stick, the subjects tracked a computer-generated airplane image on a CRT display. The airplane image excuted a low-level straight pass. At certain pseudo-random times during each 25-second run, the screen was blanked for a period of one second. When the target image reappeared, the subjects reacquired it and continued tracking, attempting to minimize vector RMS error for the entire run (including the blanked period). The results reveal an increase both in tracking error and in error variance during the blanked period, only when the target disappears while in the crossover region. Blanking at other times effected increased variance but had no effect on the mean error. A blanking period just before crossover produced an increase lag while a blanking just after crossover resulted in a lead and thus made the error curve more symmetric. A.R.H.

N79-15593*# Connecticut Univ., Storrs. Dept. of Electrical Engineering and Computer Science.

MODELING THE EFFECTS OF HIGH-G STRESS ON PILOTS IN A TRACKING TASK

Jonathan Korn and David L. Kleinman *In* NASA. Ames Res. Center The 14th Ann. Conf. on Manual Control Nov. 1978 p 55-62 refs (For primary document see N79-15588 06-54)

Avail: NTIS HC A99/MF A01 CSCL 05H

Air-to-air tracking experiments were conducted at the Aerospace Medical Research Laboratories using both fixed and moving base dynamic environment simulators. The obtained data, which includes longitudinal error of a simulated air-to-air tracking task as well as other auxiliary variables, was analyzed using an ensemble averaging method. In conjunction with these experiments, the optimal control model is applied to model a human operator under high-G stress. Author

N79-15594*# Systems Research Labs., Inc., Dayton, Ohio.

AAA GUNNERMODEL BASED ON OBSERVER THEORY

R. S. Kou, B. C. Glass, C. N. Day, and M. M. Vikmanis *In* NASA. Ames Res. Center The 14th Ann. Conf. on Manual Control Nov. 1978 p 63-74 refs Prepared in cooperation with AMRL (For primary document see N79-15588 06-54)

Avail: NTIS HC A99/MF A01 CSCL 05H

The Luenberger observer theory is used to develop a predictive model of a gunner's tracking response in antiaircraft artillery systems. This model is composed of an observer, a feedback controller and a remnant element. An important feature of the model is that the structure is simple, hence a computer simulation requires only a short execution time. A parameter identification program based on the least squares curve fitting method and the Gauss Newton gradient algorithm is developed to determine the parameter values of the gunner model. Thus, a systematic procedure exists for identifying model parameters for a given antiaircraft tracking task. Model predictions of tracking errors are compared with human tracking data obtained from manned simulation experiments. Model predictions are in excellent agreement with the empirical data for several flyby and maneuvering target trajectories. A.R.H.

N79-15595*# Illinois Univ., Urbana. Dept. of Mechanical and Industrial Engineering.

MODELING THE HUMAN AS A CONTROLLER IN A MULTITASK ENVIRONMENT

T. Govindaraj and William B. Rouse *In* NASA. Ames Res. Center The 14th Ann. Conf. on Manual Control Nov. 1978

p 75-83 refs (For primary document see N79-15588 06-54)
(Grant NsG-2119)
Avail: NTIS HC A99/MF A01 CSCL 05H

Modeling the human as a controller of slowly responding systems with preview is considered. Along with control tasks, discrete noncontrol tasks occur at irregular intervals. In multitask situations such as these, it has been observed that humans tend to apply piecewise constant controls. It is believed that the magnitude of controls and the durations for which they remain constant are dependent directly on the system bandwidth, preview distance, complexity of the trajectory to be followed, and nature of the noncontrol tasks. A simple heuristic model of human control behavior in this situation is presented. The results of a simulation study, whose purpose was determination of the sensitivity of the model to its parameters, are discussed. Author

N79-15596*# Illinois Univ., Urbana. Dept. of Psychology.

THE INTERNAL MODEL: A STUDY OF THE RELATIVE CONTRIBUTION OF PROPRIOCEPTION AND VISUAL INFORMATION TO FAILURE DETECTION IN DYNAMIC SYSTEMS

Colin Kessel and Christopher D. Wickens *In* NASA. Ames Res. Center The 14th Ann. Conf. on Manual Control Nov. 1978 p 85-97 refs (For primary document see N79-15588 06-54)
(Contract F44620-76-C-0009)
Avail: NTIS HC A99/MF A01 CSCL 05H

The development of the internal model as it pertains to the detection of step changes in the order of control dynamics is investigated for two modes of participation: whether the subjects are actively controlling those dynamics or are monitoring an autopilot controlling them. A transfer of training design was used to evaluate the relative contribution of proprioception and visual information to the overall accuracy of the internal model. Sixteen subjects either tracked or monitored the system dynamics as a 2-dimensional pursuit display under single task conditions and concurrently with a sub-critical tracking task at two difficulty levels. Detection performance was faster and more accurate in the manual as opposed to the autopilot mode. The concurrent tracking task produced a decrement in detection performance for all conditions though this was more marked for the manual mode. The development of an internal model in the manual mode transferred positively to the automatic mode producing enhanced detection performance. There was no transfer from the internal model developed in the automatic mode to the manual mode. Author

N79-15597*# Connecticut Univ., Storrs. Dept. of Electrical Engineering and Computer Science.

A COMPARISON OF MOTOR SUBMODELS IN THE OPTIMAL CONTROL MODEL

Roy E. Lancraft and David L. Kleinman *In* NASA. Ames Res. Center The 14th Ann. Conf. on Manual Control Nov. 1978 p 101-112 refs (For primary document see N79-15588 06-54)
Avail: NTIS HC A99/MF A01 CSCL 05H

Properties of several structural variations in the neuromotor interface portion of the optimal control model (OCM) are investigated. For example, it is known that commanding control-rate introduces an open-loop pole at S=0 and will generate low frequency phase and magnitude characteristics similar to experimental data. However, this gives rise to unusually high sensitivities with respect to motor and sensor noise-ratios, thereby reducing the models' predictive capabilities. Relationships for different motor submodels are discussed to show sources of these sensitivities. The models investigated include both pseudo motor-noise and actual (system driving) motor-noise characterizations. The effects of explicit proprioceptive feedback in the OCM is also examined. To show graphically the effects of each submodel on system outputs, sensitivity studies are included, and compared to data obtained from other tests. A.R.H.

N79-15598*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.

CLOSED LOOP MODELS FOR ANALYZING THE EFFECTS OF SIMULATOR CHARACTERISTICS

Sheldon Baron, Ramal Muralidharan, and David L. Kleinman *In* NASA. Ames Res. Center The 14th Ann. Conf. on Manual Control Nov. 1978 p 113-136 refs (For primary document see N79-15588 06-54)
(Contract NAS1-14449)
Avail: NTIS HC A99/MF A01 CSCL 05H

The optimal control model of the human operator is used to develop closed loop models for analyzing the effects of (digital) simulator characteristics on predicted performance and/or workload. Two approaches are considered: the first utilizes a continuous approximation to the discrete simulation in conjunction with the standard optimal control model; the second involves a more exact discrete description of the simulator in a closed loop multirate simulation in which the optimal control model simulates the pilot. Both models predict that simulator characteristics can have significant effects on performance and workload. Author

N79-15599*# Illinois Univ., Urbana. Dept. of Mechanical and Industrial Engineering.

PROSPECTS OF A MATHEMATICAL THEORY OF HUMAN BEHAVIOR IN COMPLEX MAN-MACHINE SYSTEMS TASKS

Gunnar Johannsen and William B. Rouse *In* NASA. Ames Res. Center The 14th Ann. Conf. on Manual Control Nov. 1978 p 137-159 refs (For primary document see N79-15588 06-54)
(Grant NsG-2119)
Avail: NTIS HC A99/MF A01 CSCL 05H

A hierarchy of human activities is derived by analyzing automobile driving in general terms. A structural description leads to a block diagram and a time-sharing computer analogy. The range of applicability of existing mathematical models is considered with respect to the hierarchy of human activities in actual complex tasks. Other mathematical tools so far not often applied to man machine systems are also discussed. The mathematical descriptions at least briefly considered here include utility, estimation, control, queueing, and fuzzy set theory as well as artificial intelligence techniques. Some thoughts are given as to how these methods might be integrated and how further work might be pursued. A.R.H.

N79-15600*# Institut fuer Informationsverarbeitung in Technik und Biologie, Karlsruhe (West Germany).

PETRI NETS AS A MODELING TOOL FOR DISCRETE CONCURRENT TASKS OF THE HUMAN OPERATOR

W. Schumacher and G. Geiser *In* NASA. Ames Res. Center The 14th Ann. Conf. on Manual Control Nov. 1978 p 161-175 refs (For primary document see N79-15588 06-54)
Avail: NTIS HC A99/MF A01 CSCL 05H

The basic concepts of Petri nets are reviewed as well as their application as the fundamental model of technical systems with concurrent discrete events such as hardware systems and software models of computers. The use of Petri nets is proposed for modeling the human operator dealing with concurrent discrete tasks. Their properties useful in modeling the human operator are discussed and practical examples are given. By means of and experimental investigation of binary concurrent tasks which are presented in a serial manner, the representation of human behavior by Petri nets is demonstrated. A.R.H.

N79-15601*# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

DISCRETE-TIME PILOT MODEL

Daniel Cavalli *In* NASA. Ames Res. Center The 14th Ann. Conf. on Manual Control Nov. 1978 p 177-186 refs (For primary document see N79-15588 06-54)
Avail: NTIS HC A99/MF A01 CSCL 05H

Pilot behavior is considered as a discrete-time process where the decision making has a sequential nature. This model differs from both the quasilinear model which follows from classical control theory and from the optimal control model which considers the human operator as a Kalman estimator-predictor. An additional factor considered is that the pilot's objective may not be adequately formulated as a quadratic cost functional to be minimized, but rather as a more fuzzy measure of the closeness with which the aircraft follows a reference trajectory. All model parameters, in the digital program simulating the pilot's behavior, were successfully compared in terms of standard-deviation and performance with those of professional pilots in IFR configuration. The first practical application of the model

was in the study of its performance degradation when the aircraft model static margin decreases. A.R.H.

N79-15602*# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.

FLIGHT EXPERIENCE WITH MANUALLY CONTROLLED UNCONVENTIONAL AIRCRAFT MOTIONS

A. Finley Barfield *In* NASA. Ames Res. Center The 14th Ann. Conf. on Manual Control Nov. 1978 p 189-205 (For primary document see N79-15588 06-54)

Avail: NTIS HC A99/MF A01 CSCL 05H

A modified YF-16 aircraft was used to flight demonstrate decoupled modes under the USAF Fighter Control Configured Vehicle (CCV) Program. The direct force capabilities were used to implement seven manually controlled unconventional modes on the aircraft, allowing flat turns, decoupled normal acceleration control, independent longitudinal and lateral translations, uncoupled elevation and azimuth aiming, and blended direct lift. This paper describes the design, development, and flight testing of these control modes. The need for task-tailored mode authorities, gain-scheduling and selected closed-loop design is discussed. Author

N79-15603*# Purdue Univ., Lafayette, Ind. School of Aeronautics and Astronautics.

PILOT-OPTIMAL AUGMENTATION SYNTHESIS

David K. Schmidt *In* NASA. Ames Res. Center The 14th Ann. Conf. on Manual Control Nov. 1978 p 207-219 refs (For primary document see N79-15588 06-54)

Avail: NTIS HC A99/MF A01 CSCL 05H

An augmentation synthesis method usable in the absence of quantitative handling qualities specifications, and yet explicitly including design objectives based on pilot-rating concepts, is presented. The algorithm involves the unique approach of simultaneously solving for the stability augmentation system (SAS) gains, pilot equalization and pilot rating prediction via optimal control techniques. Simultaneous solution is required in this case since the pilot model (gains, etc.) depends upon the augmented plant dynamics, and the augmentation is obviously not a priori known. Another special feature is the use of the pilot's objective function (from which the pilot model evolves) to design the SAS. Author

N79-15604*# Northrop Corp., Hawthorne, Calif. Aircraft Group.

PREDICTION, EVALUATION, AND SPECIFICATION OF FLYING QUALITIES BY MEANS OF STEP TARGET TRACKING

E. D. Onstott and W. H. Faulkner *In* NASA. Ames Res. Center The 14th Ann. Conf. on Manual Control Nov. 1978 p 221-235 refs (For primary document see N79-15588 06-54)

(Contract F33615-77-C-3008)

Avail: NTIS HC A99/MF A01 CSCL 05H

A new approach to flying qualities specification and evaluation is presented which coordinates current research in the areas of pilot ratings, pilot-aircraft modeling techniques, and simulation and flight test procedures. A time-domain pilot model is described which can model discontinuous and nonlinear pilot behavior in conjunction with completely general time-varying nonlinear aircraft models to simulate discrete maneuvers. This pilot-aircraft model is applied to an existing set of in-flight simulation data, and calculates tracking error and time-on-target statistics for step target tracking that directly relate to the reported pilot comments and ratings. Predicted step target tracking data for eighteen F-5E flight conditions are presented, and the use of the method for control system design is demonstrated using the YF-17. Author

N79-15605*# Illinois Univ., Urbana. Dept. of Mechanical and Industrial Engineering.

ANALYSIS OF A VTOL HOVER TASK WITH PREDICTOR DISPLAYS USING AN OPTIMAL CONTROL MODEL OF THE HUMAN OPERATOR

Gunnar Johannsen and T. Govindaraj *In* NASA. Ames Res. Center The 14th Ann. Conf. on Manual Control Nov. 1978 p 237-251 refs (For primary document see N79-15588 06-54)

(Grant NsG-2119)

Avail: NTIS HC A99/MF A01 CSCL 05H

The influence of different types of predictor displays in a longitudinal VTOL hover task is analyzed in a theoretical study. It was assumed that pitch angle and position are presented to the pilot in separate displays namely the artificial horizon and position display. The predictive information is calculated by means of a Taylor series. From earlier experimental studies it is well known that predictor displays improve human and system performance and result in reducing human workload. In this study, an optimal control model is used to prove this effect theoretically. Several cases with differing amounts of predictive and rate information are compared. G.Y.

N79-15606*# Waterloo Univ. (Ontario). Dept. of Systems Design.

VEHICLE STEERING CONTROL: A MODEL OF LEARNING

Alison Smiley, Lloyd Reid, and Morris Fraser *In* NASA. Ames Res. Center The 14th Ann. Conf. on Manual Control Nov. 1978 p 255-266 refs Sponsored by Natl. Res. Council of Canada Prepared in cooperation with Southern California Res. Inst. and Toronto Univ. (For primary document see N79-15588 06-54)

Avail: NTIS HC A99/MF A01 CSCL 05H

A hierarchy of strategies were postulated to describe the process of learning steering control. Vehicle motion and steering control data were recorded for twelve novices who drove an instrumented car twice a week during and after a driver training course. Car-driver describing functions were calculated, the probable control structure determined, and the driver-alone transfer function modelled. The data suggested that the largest changes in steering control with learning were in the way the driver used the lateral position cue. G.Y.

N79-15607*# Systems Technology, Inc., Hawthorne, Calif.

USE OF REWARD-PENALTY STRUCTURES IN HUMAN EXPERIMENTATION

Anthony C. Stein, R. Wade Allen, and Stephen H. Schwartz *In* NASA. Ames Res. Center The 14th Ann. Conf. on Manual Control Nov. 1978 p 267-278 refs (For primary document see N79-15588 06-54)

Avail: NTIS HC A99/MF A01 CSCL 05H

The use of motivational techniques in human performance research is reviewed and an example study employing a reward-penalty structure to simulate the motivations inherent in a real-world situation is presented. Driver behavior in a decision-making driving scenario was studied. The task involved control of an instrumented car on a cooperative test course. Subjects were penalized monetarily for tickets and accidents and rewarded for saving driving time. Two groups were assigned different ticket penalties. The group with the highest penalties tended to drive more conservatively. However, the average total payoff to each group was the same, as the conservative drivers traded off slower driving times with lower ticket penalties. G.Y.

N79-15608*# General Motors Research Labs., Warren, Mich. Dept. of Engineering Mechanics.

THE INFLUENCE OF VEHICLE AERODYNAMIC AND CONTROL RESPONSE CHARACTERISTICS ON DRIVER-VEHICLE PERFORMANCE

Alexander A. Alexandridis, Brian S. Repa, and Walter W. Wierwille *In* NASA. Ames Res. Center The 14th Ann. Conf. on Manual Control Nov. 1978 p 279-294 refs Prepared in cooperation with Virginia Polytech. Inst. and State Univ. (For primary document see N79-15588 06-54)

Avail: NTIS HC A99/MF A01 CSCL 05H

The effects of changes in understeer, control sensitivity, and location of the lateral aerodynamic center of pressure (c.p.) of a typical passenger car on the driver's opinion and on the performance of the driver-vehicle system were studied in a moving-base driving simulator. Twelve subjects with no prior experience on the simulator and no special driving skills performed regulation tasks in the presence of both random and step wind gusts. G.Y.

N79-15609*# Forschungsinstitut fuer Anthropotechnik, Meckenheim (West Germany).

THE DETERMINATION OF THE OPERATING RANGE OF A TWIN-GRIP CONTROL YOKE THROUGH BIOMECHANICAL MEANS

Klaus-Peter Gaertner *In* NASA. Ames Res. Center The 14th

Ann. Conf. on Manual Control Nov. 1978 p 297-306 refs (For primary document see N79-15588 06-54)
Avail: NTIS HC A99/MF A01 CSCL 05H

A twin-grip control yoke was designed as an ergonomic case study that allows dual axis control inputs, both axes being rotational. Inputs are effected by rotating the grips. How the handles were designed with respect to their shape and size and how the angular range of the control yoke in both rotational axes was evaluated. The control yoke which requires two-hand operation was tested to determine its operating range. The intention of this investigation was to find out the optimal form of the control yoke and the maximum permissible range in both rotating axes. In these experiments controls had no spring resistance. G.Y.

N79-15610*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
EVENT-DRIVEN DISPLAYS FOR MANIPULATOR CONTROL
A. K. Bejczy and G. Paine *In* NASA. Ames Res. Center The 14th Ann. Conf. on Manual Control Nov. 1978 p 307-332 refs (For primary document see N79-15588 06-54)
(Contract NAS7-100)
Avail: NTIS HC A99/MF A01 CSCL 05H

The problem of constructing event-related information displays from multidimensional data generated by proximity, force-torque and tactile sensors integrated with the terminal device of a remotely controlled manipulator is considered. Event-driven displays are constructed by using appropriate algorithms acting on sensory data in real time. Event-driven information displays lessen the operator's workload and improve control performance. The paper describes and discusses several event-driven display examples that were implemented in the JPL teleoperator project, including a brief outline of the data handling system which drives the graphics display in real time. The paper concludes with a discussion of future plans to integrate event-driven displays with visual (TV) information. G.Y.

N79-15611*# CAE Electronics Ltd., Montreal (Quebec).
MANNED SIMULATIONS OF THE SRMS IN SIMFAC
Andrew L. Lippay, Graham D. Whitehead, and Claus G. Wagner-Bartak *In* NASA. Ames Res. Center The 14th Ann. Conf. on Manual Control Nov. 1978 p 333-341 Prepared in cooperation with Spar Aerospace Products Ltd., Toronto (For primary document see N79-15588 06-54)
Avail: NTIS HC A99/MF A01 CSCL 05H

SIMFAC is a general purpose real-time simulation facility currently configured with an Orbiter-like Crew Compartment and a Displays and Controls (D and C) Subsystem to support the engineering developments of the Space Shuttle Remote Manipulator (SRMS). The simulation consists of a software model of the anthropomorphic SRMS manipulator arm including the characteristics of its control system and joint drive modules. The following are discussed: (1) simulation and scene generation subsystems; (2) the SRMS task in SIMFAC; (3) operator tactics and options; (4) workload; (5) operator errors and sources; (6) areas for further work; and (7) general observations. G.Y.

N79-15612*# Massachusetts Inst. of Tech., Cambridge. Man-Machine Systems Lab.
HUMAN/COMPUTER CONTROL OF UNDERSEA TELEOPERATORS
T. B. Sheridan, W. L. Verplank, and T. L. Brooks *In* NASA. Ames Res. Center The 14th Ann. Conf. on Manual Control Nov. 1978 p 343-357 (For primary document see N79-15588 06-54)
(Contract N00014-77-C-0256)
Avail: NTIS HC A99/MF A01 CSCL 05H

The potential of supervisory controlled teleoperators for accomplishment of manipulation and sensory tasks in deep ocean environments is discussed. Teleoperators and supervisory control are defined, the current problems of human divers are reviewed, and some assertions are made about why supervisory control has potential use to replace and extend human diver capabilities. The relative roles of man and computer and the variables involved in man-computer interaction are next discussed. Finally, a detailed description of a supervisory controlled teleoperator system, SUPERMAN, is presented. G.Y.

N79-15613*# Massachusetts Inst. of Tech., Cambridge. Man-Machine Systems Lab.
DISPLAY AIDS FOR REMOTE CONTROL OF UNTETHERED UNDERSEA VEHICLES
W. L. Verplank *In* NASA. Ames Res. Center The 14th Ann. Conf. on Manual Control Nov. 1978 p 361-369 refs (For primary document see N79-15588 06-54)
(Contract N00014-77-C-0256)
Avail: NTIS HC A99/MF A01 CSCL 05H

A predictor display superimposed on slow-scan video or sonar data is proposed as a method to allow better remote manual control of an untethered submersible. Simulation experiments show good control under circumstances which otherwise make control practically impossible. Author

N79-15614*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A SAFETY MARGIN AND FLIGHT REFERENCE SYSTEM AND DISPLAY FOR POWERED-LIFT AIRCRAFT
Robert K. Heffley and Gordon H. Hardy *In its* The 14th Ann. Conf. on Manual Control Nov. 1978 p 371-379 refs Prepared in cooperation with Systems Technol., Inc., Hawthorne, Calif. (For primary document see N79-15588 06-54)
(Contract NAS2-9418)
Avail: NTIS HC A99/MF A01 CSCL 05H

A study was conducted to explore the feasibility of a safety margin and flight reference system for those powered-lift aircraft which require a backside piloting technique. The main objective was to display multiple safety margin criteria as a single variable which could be tracked both manually and automatically and which could be monitored in order to derive safety margin status. The study involved a pilot-in-the-loop analysis of several system concepts and a simulator experiment to evaluate those concepts showing promise. A system was ultimately configured which yielded reasonable compromises in controllability, status information content, and the ability to regulate safety margins at some expense of the allowable low speed flight path envelope. G.Y.

N79-15615*# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
A HEAD-UP DISPLAY FOR MID-AIR DRONE RECOVERY
W. L. Augustine, E. L. Heft, T. E. Bowen, and R. L. Newman *In* NASA. Ames Res. Center The 14th Ann. Conf. on Manual Control Nov. 1978 p 381-394 refs Prepared in cooperation with Tactical Drone Squadron (11th), Davis-Monthan AFB, Ariz. and Crew Systems Consultants, Yellow Springs, Ohio (For primary document see N79-15588 06-54)
Avail: NTIS HC A99/MF A01 CSCL 05H

During mid-air retrieval of parachute packages, the absence of a natural horizon creates serious difficulties for the pilot of the recovery helicopter. A head-up display (HUD) was tested in an attempt to solve this problem. Both a roll-stabilized HUD and a no-roll (pitch only) HUD were tested. The results show that fewer missed passes occurred with the roll-stabilized HUD when the horizon was obscured. The pilots also reported that the workload was greatly reduced. Roll-stabilization was required to prevent vertigo when flying in the absence of a natural horizon. Any HUD intended for mid-air retrieval should display pitch, roll, sideslip, airspeed, and vertical velocity. G.Y.

N79-15616*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
EVALUATION OF DISPLAY AND CONTROL CONCEPTS FOR A TERMINAL CONFIGURED VEHICLE IN FINAL APPROACH IN A WINDSHEAR ENVIRONMENT
William H. Levison *In* NASA. Ames Res. Center The 14th Ann. Conf. on Manual Control Nov. 1978 p 395-415 refs (For primary document see N79-15588 06-54)
(Contract NAS1-13842)
Avail: NTIS HC A99/MF A01 CSCL 05H

A revised treatment of nonrandom inputs was incorporated in the model. Response behavior was observed for two display configurations (a pictorial EADI presentation and a flight-director configuration requiring use of a panel-mounted airspeed indicator), two control configurations (attitude and velocity control wheel steering), and two shear environments, each of which contained a head-to-tail shear and a vertical component. In general, performance trends predicted by the model were confirmed

experimentally. Experimental and analytical results both indicated superiority to the EADI display with respect to regulation of height and airspeed errors. Velocity steering allowed tighter regulation of height errors, but control parameters had little influence on airspeed regulation. Model analysis indicated that display-related differences could be ascribed to differences in the quality of speed-related information provided by the two displays. Author

N79-15617*# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio. Human Engineering Div.

TWO DIMENSIONAL EYE TRACKING: SAMPLING RATE OF FORCING FUNCTION

John P. Hornseth, Donald L. Monk, James L. Porterfield, and Robert L. McMurry (Systems Res. Lab., Dayton, Ohio) *In* NASA. Ames Res. Center The 14th Ann. Conf. on Manual Control Nov. 1978 p 419-423 refs (For primary document see N79-15588 06-54)

Avail: NTIS HC A99/MF A01 CSCL 05H

A study was conducted to determine the minimum update rate of a forcing function display required for the operator to approximate the tracking performance obtained on a continuous display. In this study, frequency analysis was used to determine whether there was an associated change in the transfer function characteristics of the operator. It was expected that as the forcing function display update rate was reduced, from 120 to 15 samples per second, the operator's response to the high frequency components of the forcing function would show a decrease in gain, an increase in phase lag, and a decrease in coherence. Author

N79-15618*# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio. Human Engineering Div.

HEAD TRACKING AT LARGE ANGLES FROM THE STRAIGHT AHEAD POSITION

Donald L. Monk, James L. Porterfield, John P. Hornseth, and Robert L. McMurry (Systems Res. Lab., Dayton, Ohio) *In* NASA. Ames Res. Center The 14th Ann. Conf. on Manual Control Nov. 1978 p 425-436 refs (For primary document see N79-15588 06-54)

Avail: NTIS HC A99/MF A01 CSCL 05H

One of the big advantages of a helmet sight in a high performance aircraft is its off-boresight capability in aiming a fire control system. However, tracking data using a target that is moving rapidly and randomly for an extended period of time is missing. This study is intended to provide data in this area that will be of value to engineers in designing head control systems. Author

N79-15619*# Human Engineering Labs., Aberdeen Proving Ground, Md.

LIGHTWEIGHT HELMET-MOUNTED EYE MOVEMENT MEASUREMENT SYSTEM

John A. Barnes *In* NASA. Ames Res. Center The 14th Ann. Conf. on Manual Control Nov. 1978 p 437-440 (For primary document see N79-15588 06-54)

Avail: NTIS HC A99/MF A01 CSCL 05H

The helmet-mounted eye movement measuring system, weighs 1,530 grams; the weight of the present aviators' helmet in standard form with the visor is 1,545 grams. The optical head is standard NAC Eye-Mark. This optical head was mounted on a magnesium yoke which in turn was attached to a slide cam mounted on the flight helmet. The slide cam allows one to adjust the eye-to-optics system distance quite easily and to secure it so that the system will remain in calibration. The design of the yoke and slide cam is such that the subject can, in an emergency, move the optical head forward and upward to the stowed and locked position atop the helmet. This feature was necessary for flight safety. The television camera that is used in the system is a solid state General Electric TN-2000 with a charged induced device imager used as the vidicon. L.S.

N79-15620*# Systems Research Labs., Inc., Dayton, Ohio.

THE EFFECTS OF CLOSED LOOP TRACKING ON A SUBJECTIVE TILT THRESHOLD IN THE ROLL AXIS

Marvin Roark and Andrew M. Junker (Aerospace Med. Res. Lab.) *In* NASA. Ames Res. Center The 14th Ann. Conf. on Manual Control Nov. 1978 p 443-450 refs (For primary document see N79-15588 06-54)

Avail: NTIS HC A99/MF A01 CSCL 05H

The indifference thresholds for the perception of tilt in the roll axis were experimentally determined in a moving base simulator under three tracking task difficulties. The threshold level determined in this experiment is approximately 5 to 7 degrees (.lg). Author

N79-15621*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.

USE OF THE TILT CUE IN A SIMULATED HEADING TRACKING TASK

William H. Levison and Andrew M. Junker (Aerospace Med. Res. Lab.) *In* NASA. Ames Res. Center The 14th Ann. Conf. on Manual Control Nov. 1978 p 451-462 refs (For primary document see N79-15588 06-54)

(Contract F44620-74-C-0060)

Avail: NTIS HC A99/MF A01 CSCL 05H

The task was performed with subjects using visual-only cues and combined visual and roll-axis motion cues. Half of the experimental trials were conducted with the simulator rotating about the horizontal axis; to suppress the tilt cue, the remaining trials were conducted with the simulator cab tilted 90 deg so that roll-axis motions were about earth vertical. The presence of the tilt cue allowed a substantial and statistically significant reduction in performance scores. When the tilt cue was suppressed, the availability of motion cues did not result in significant performance improvement. These effects were accounted for by the optimal-control pilot/vehicle model, wherein the presence or absence of various motion cues was represented by appropriate definition of the perceptual quantities assumed to be used by the human operator. Author

N79-15622*# Systems Technology, Inc., Hawthorne, Calif.

ROLL TRACKING EFFECTS OF G-VECTOR TILT AND VARIOUS TYPES OF MOTION WASHOUT

Henry R. Jex, Raymond E. Magdaleno, and Andrew M. Junker (Aerospace Med. Res. Lab.) *In* NASA. Ames Res. Center The 14th Ann. Conf. on Manual Control Nov. 1978 p 483-502 refs (For primary document see N79-15588 06-54)

Avail: NTIS HC A99/MF A01 CSCL 05H

In a dogfight scenario, the task was to follow the target's roll angle while suppressing gust disturbances. All subjects adopted the same behavioral strategies in following the target while suppressing the gusts, and the MFP-fitted math model response was generally within one data symbol width. The results include the following: (1) comparisons of full roll motion (both with and without the spurious gravity tilt cue) with the static case. These motion cues help suppress disturbances with little net effect on the visual performance. Tilt cues were clearly used by the pilots but gave only small improvement in tracking errors. (2) The optimum washout (in terms of performance close to real world, similar behavioral parameters, significant motion attenuation (60 percent), and acceptable motion fidelity) was the combined attenuation and first-order washout. (3) Various trends in parameters across the motion conditions were apparent, and are discussed with respect to a comprehensive model for predicting adaptation to various roll motion cues. Author

N79-15623*# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.

A METHOD MOTION SIMULATOR DESIGN BASED ON MODELING CHARACTERISTICS OF THE HUMAN OPERATOR

D. W. Repperger and A. M. Junker *In* NASA. Ames Res. Center The 14th Ann. Conf. on Manual Control Nov. 1978 p 503-519 refs (For primary document see N79-15588 06-54)

Avail: NTIS HC A99/MF A01 CSCL 05H

A design criteria is obtained to compare two simulators and evaluate their equivalence or credibility. In the subsequent analysis the comparison of two simulators can be considered as the same problem as the comparison of a real world situation and a simulation's representation of this real world situation. The design criteria developed involves modeling of the human operator and defining simple parameters to describe his behavior in the simulator and in the real world situation. In the process of obtaining human operator parameters to define characteristics to evaluate simulators, measures are also obtained on these human operator

characteristics which can be used to describe the human as an information processor and controller. First, a study is conducted on the simulator design problem in such a manner that this modeling approach can be used to develop a criteria for the comparison of two simulators. Author

N79-15624*# Systems Technology, Inc., Hawthorne, Calif.
INVESTIGATION OF NONLINEAR MOTION SIMULATOR WASHOUT SCHEMES
Susan A. Riedel and L. G. Hofmann *In* NASA. Ames Res. Center The 14th Ann. Conf. on Manual Control Nov. 1978 p 521-532 refs (For primary document see N79-15588 06-54)
(Contract F33615-77-C-2065)
Avail: NTIS HC A99/MF A01 CSCL 05H

An overview is presented of some of the promising washout schemes which have been devised. The four schemes presented fall into two basic configurations; crossfeed and crossproduct. Various nonlinear modifications further differentiate the four schemes. One nonlinear scheme is discussed in detail. This washout scheme takes advantage of subliminal motions to speed up simulator cab centering. It exploits so-called perceptual indifference thresholds to center the simulator cab at a faster rate whenever the input to the simulator is below the perceptual indifference level. The effect is to reduce the angular and translational simulation motion by comparison with that for the linear washout case. Finally, the conclusions and implications for further research in the area of nonlinear washout filters are presented. L.S.

N79-15625*# National Aerospace Lab., Amsterdam (Netherlands).
A THEORETICAL AND EXPERIMENTAL ANALYSIS OF THE OUTSIDE WORLD PERCEPTION PROCESS
P. H. Wewerinke *In* NASA. Ames Res. Center The 14th Ann. Conf. on Manual Control Nov. 1978 p 535-555 refs (For primary document see N79-15588 06-54)
Avail: NTIS HC A99/MF A01 CSCL 05H

The outside scene is often an important source of information for manual control tasks. Important examples of these are car driving and aircraft control. This paper deals with modelling this visual scene perception process on the basis of linear perspective geometry and the relative motion cues. Model predictions utilizing psychophysical threshold data from base-line experiments and literature of a variety of visual approach tasks are compared with experimental data. Both the performance and workload results illustrate that the model provides a meaningful description of the outside world perception process, with a useful predictive capability. Author

N79-15626*# Illinois Univ., Urbana. Dept. of Psychology.
LINEAR MODELLING OF ATTENTIONAL RESOURCE ALLOCATION
Byron Pierce *In* NASA. Ames Res. Center The 14th Ann. Conf. on Manual Control Nov. 1978 p 419-423 refs (For primary document see N79-15588 06-54)
(Grant AF-AFOSR-3380-77)
Avail: NTIS HC A99/MF A01 CSCL 05H

Eight subjects time-shared performance of two compensatory tracking tasks under conditions when both were of constant difficulty, and when the control order of one task (designated primary) was varied over time within a trial. On line performance feedback was presented on half of the trials. The data are interpreted in terms of a linear model of the operator's attention allocation system, and suggest that this allocation is strongly suboptimal. Furthermore, the limitations in reallocating attentional resources between tasks, in response to difficulty fluctuations were not reduced by augmented performance feedback. Some characteristics of the allocation system are described, and reasons for its limitations suggested. Author

N79-15627*# Massachusetts Inst. of Tech., Cambridge. Man-Machine Systems Lab.
A MODEL FOR DYNAMIC ALLOCATION OF HUMAN ATTENTION AMONG MULTIPLE TASKS
Thomas B. Sheridan and M. Kamil Tulga *In* NASA. Ames Res. Center The 14th Ann. Conf. on Manual Control Nov. 1978 p 569-592 refs (For primary document see N79-15588 06-54)
(Grant NsG-2118)
Avail: NTIS HC A99/MF A01 CSCL 05H

The problem of multi-task attention allocation with special reference to aircraft piloting is discussed with the experimental paradigm used to characterize this situation and the experimental results obtained in the first phase of the research. A qualitative description of an approach to mathematical modeling, and some results obtained with it are also presented to indicate what aspects of the model are most promising. Two appendices are given which (1) discuss the model in relation to graph theory and optimization and (2) specify the optimization algorithm of the model. Author

N79-15628*# San Jose State Univ., Calif.
PERPETUAL FACTORS INVOLVED IN PERFORMANCE OF AIR TRAFFIC CONTROLLERS USING A MICROWAVE LANDING SYSTEM
Gary Gershzohn *In* NASA. Ames Res. Center The 14th Ann. Conf. on Manual Control Nov. 1978 p 593-606 refs (For primary document see N79-15588 06-54)
(Grants NGL-05-046-002; NsG-2269)
Avail: NTIS HC A99/MF A01 CSCL 05H

The task involved the control of two simulated aircraft targets per trial, in a 37.0 -km radius terminal area, by means of conventional radar vectoring and/or speed control. The goal was to insure that the two targets crossed the Missed Approach Point (MAP) at the runway threshold exactly 60 sec apart. The effects on controller performance of the MLS configuration under wind and no-wind conditions were examined. The data for mean separation time between targets at the MAP and the range about that mean were analyzed by appropriate analyses of variance. Significant effects were found for mean separation times as a result of the configuration of the MLS and for interaction between the configuration and wind conditions. The analysis of variance for range indicated significantly poorer performance under the wind condition. These findings are believed to be a result of certain perceptual factors involved in radar air traffic control (ATC) using the MLS with separation of targets in time. Author

N79-15629*# Systems Technology, Inc., Hawthorne, Calif.
THE EFFECTS OF ALCOHOL ON DRIVER PERFORMANCE IN A DECISION MAKING SITUATION
R. Wade Allen, Stephen H. Schwartz, Anthony C. Stein, and Jeffrey R. Hogge *In* NASA. Ames Res. Center The 14th Ann. Conf. on Manual Control Nov. 1978 p 609-629 refs Sponsored in part by Natl. Highway Traffic Safety Admin. (For primary document see N79-15588 06-54)
Avail: NTIS HC A99/MF A01 CSCL 05H

The results are reviewed of driving simulator and in-vehicle field test experiments of alcohol effects on driver risk taking. The objective was to investigate changes in risk taking under alcoholic intoxication and relate these changes to effects on traffic safety. The experiments involved complex 15 minute driving scenarios requiring decision making and steering and speed control throughout a series of typical driving situations. Monetary rewards and penalties were employed to simulate the real-world motivations inherent in driving. A full placebo experimental design was employed, and measures related to traffic safety, driver/vehicle performance and driver behavior were obtained. Alcohol impairment was found to increase the rate of accidents and speeding tickets. Behavioral measures showed these traffic safety effects to be due to impaired psychomotor performance and perceptual distortions. Subjective estimates of risk failed to show any change in the driver's willingness to take risks when intoxicated. Author

N79-15630*# Systems Technology, Inc., Hawthorne, Calif.
A DECISION MODEL APPLIED TO ALCOHOL EFFECTS ON DRIVER SIGNAL LIGHT BEHAVIOR
Stephen H. Schwartz and R. Wade Allen *In* NASA Ames Res. Center The 14th Ann. Conf. on Manual Control Nov. 1978 p 631-645 refs (For primary document see N79-15588 06-54)
(Contract DOT-HS-4-00999)
Avail: NTIS HC A99/MF A01 CSCL 05H

A decision model including perceptual noise or inconsistency is developed from expected value theory to explain driver stop and go decisions at signaled intersections. The model is applied to behavior in a car simulation and instrumented vehicle. Objective

and subjective changes in driver decision making were measured with changes in blood alcohol concentration (BAC). Treatment levels averaged 0.00, 0.10 and 0.14 BAC for a total of 26 male subjects. Data were taken for drivers approaching signal lights at three timing configurations. The correlation between model predictions and behavior was highly significant. In contrast to previous research, analysis indicates that increased BAC results in increased perceptual inconsistency, which is the primary cause of increased risk taking at low probability of success signal lights. Author

N79-15631*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.

COMBINED MONITORING, DECISION AND CONTROL MODEL FOR THE HUMAN OPERATOR IN A COMMAND AND CONTROL DESK

Ramal Muralidharan and Sheldon Baron *In* NASA. Ames Res. Center The 14th Ann. Conf. on Manual Control Nov. 1978 p 647-662 refs (For primary document see N79-15588 06-54)
(Contract F44620-76-C-0029)
Avail: NTIS HC A99/MF A01 CSCL 05H

A report is given on the ongoing efforts to mode the human operator in the context of the task during the enroute/return phases in the ground based control of multiple flights of remotely piloted vehicles (RPV). The approach employed here uses models that have their analytical bases in control theory and in statistical estimation and decision theory. In particular, it draws heavily on the modes and the concepts of the optimal control model (OCM) of the human operator. The OCM is being extended into a combined monitoring, decision, and control model (DEMON) of the human operator by infusing decision theoretic notions that make it suitable for application to problems in which human control actions are infrequent and in which monitoring and decision-making are the operator's main activities. Some results obtained with a specialized version of DEMON for the RPV control problem are included. Author

N79-15632*# Illinois Univ., Urbana. Dept. of Mechanical and Industrial Engineering.

A MODEL OF HUMAN EVENT DETECTION IN MULTIPLE PROCESS MONITORING SITUATIONS

Joel S. Greenstein and William B. Rouse *In* NASA. Ames Res. Center The 14th Ann. Conf. on Manual Control Nov. 1978 p 663-675 refs (For primary document see N79-15588 06-54)
(Grant NsG-2119)
Avail: NTIS HC A99/MF A01 CSCL 05H

It is proposed that human decision making in many multi-task situations might be modeled in terms of the manner in which the human detects events related to his tasks and the manner in which he allocates his attention among his tasks once he feels events have occurred. A model of human event detection performance in such a situation is presented. An assumption of the model is that, in attempting to detect events, the human generates the probability that events have occurred. Discriminant analysis is used to model the human's generation of these probabilities. An experimental study of human event detection performance in a multiple process monitoring situation is described and the application of the event detection model to this situation is addressed. The experimental study employed a situation in which subjects simulataneously monitored several dynamic processes for the occurrence of events and made yes/no decisions on the presence of events in each process. Input to the event detection model of the information displayed to the experimental subjects allows comparison of the model's performance with the performance of the subjects. Author

N79-15633*# Illinois Univ., Urbana. Dept. of Mechanical and Industrial Engineering.

PILOT DECISION MAKING IN A COMPUTER-AIDED FLIGHT MANAGEMENT SITUATION

Yee-Yeen Chu and William B. Rouse *In* NASA. Ames Res. Center The 14th Ann. Conf. on Manual Control Nov. 1978 p 677-690 refs (For primary document see N79-15588 06-54)
(Grant NsG-2119)
Avail: NTIS HC A99/MF A01 CSCL 05H

An experimental representation of a computer-aided multi-task flight management situation has been developed. A computer aiding program was implemented to serve as a back-up decision maker. An experiment was conducted with a balanced design of several subject runs for different workload levels. This was achieved using three levels of subsystem event arrival rates, three levels of control task involvement, and three levels of availability of computer aiding. Experimental results compared quite favorably with those from a computer simulation which employed a queueing model. It was shown that the aiding had enhanced system performance as well as subjective ratings, and that the adaptive aiding policy further reduced subsystem delay. Author

N79-15634*# Utah Univ., Salt Lake City.

TIME ESTIMATION AS A SECONDARY TASK TO MEASURE WORKLOAD: SUMMARY OF RESEARCH

Sandra G. Hart, Duncan McPherson (Calif. Univ., Berkeley), and Leslie L. Loomis (San Jose State Univ.) *In* NASA. Ames Res. Center The 14th Ann. Conf. on Manual Control Nov. 1978 p 693-712 refs (For primary document see N79-15588 06-54)
(Grant NGR-45-003-108; NsG-2269)
Avail: NTIS HC A99/MF A01 CSCL 05H

Actively produced intervals of time were found to increase in length and variability, whereas retrospectively produced intervals decreased in length although they also increased in variability with the addition of a variety of flight-related tasks. If pilots counted aloud while making a production, however, the impact of concurrent activity was minimized, at least for the moderately demanding primary tasks that were selected. The effects of feedback on estimation accuracy and consistency were greatly enhanced if a counting or tapping production technique was used. This compares with the minimal effect that feedback had when no overt timekeeping technique was used. Actively made verbal estimates of sessions filled with different activities performed during the interval were increased. Retrospectively made verbal estimates, however, increased in length as the amount and complexity of activities performed during the interval were increased. Author

N79-15635*# Nebraska Univ., Lincoln. College of Engineering and Technology.

THE PROTO-TYPE WRIST JOINT ASSEMBLY TACPAW (TRIPLE AXIS COMMON PIVOT ARM WRIST), PHASE 2 Final Report

Leendert Kersten Nov. 1978 67 p
(Contract NAS8-31897)
(NASA-CR-150885) Avail: NTIS HC A04/MF A01 CSCL 05H

A wrist joint assembly is described for use with a mechanical manipulator arm for finely positioning an end-effector carried by the wrist joint on the terminal end of the manipulator arm. The wrist joint assembly is pivotable about a first axis to produce a yaw motion, a second axis to produce a pitch motion, and a third axis to produce a roll motion. The performance of the wrist configuration is indicative of the capability to produce the 15 ft lb torque in either one of the three motions and the smoothness of operation is notable. G.G.

N79-15636# Defence Research Establishment, Ottawa. (Ontario).

PATTERN OF HEAT LOSS FROM A SUBJECT WEARING CF TEMPERATE-CLIMATE COMBAT CLOTHING

David J. Hidson and Rita M. Crow Jun. 1978 21 p refs
(AD-A057746; DREO-TN-78-5) Avail: NTIS HC A02/MF A01 CSCL 05/9

The patterns of heat loss from a subject wearing CF temperate climate combat clothing using thermal imaging techniques are examined. The main advantage of thermal imaging is that it presents a complete picture of the surface with a continuous map of temperatures displayed as a black-and-white TV image. This image is both qualitative and quantitative. The thermogram can be compared directly with a photograph of the same subject and the positions of the main areas of heat loss are immediately apparent. G.Y.

N79-15637# Defence Research Establishment, Ottawa. (Ontario).

EVALUATION OF BRITISH AND CANADIAN CONDUCTIVE RUBBER HEATING ELEMENTS FOR HANDWEAR: PRELIMINARY REPORT

Richard W. Nolan and Stanley W. Cattroll Feb. 1978 19 p

refs
(AD-A052826; DREO-TN-77-24) Avail: NTIS HC A02/MF A01 CSCL 15/5

A physiological evaluation of British and Canadian conductive rubber heating elements for use in electrically-heated handwear was carried out in the DREO cold room at -40 C. It was found that the difference between the mean hand temperatures of test subjects wearing either type of handwear was not significant. Author (GRA)

N79-15638# Naval Surface Weapons Center, White Oak, Md.
INVESTIGATION OF TECHNIQUES TO REDUCE ELECTROSTATIC DISCHARGE SUSCEPTIBILITY OF EED'S CONTAINING PLASTIC PLUGS
Howard S. Leopold, Gerald R. Laib, and Louis A. Rosenthal 25 Aug. 1978 34 p
(AD-A059982; NSWC/WOL/TR-78-82) Avail: NTIS HC A03/MF A01 CSCL 19/1

Techniques to increase the safety of Navy electroexplosive devices (EED) to a level where they will be immune to human electrostatic discharge are investigated. A protective technique was desired which would not make the EED unduly sensitive to other types of accidental initiation. It was also desired to find a technique that would require a minimum of modification to the various existing EEDs. This report deals specifically with finding a protective technique for EEDs containing a plastic initiator plug. The Mk 70-0 detonator was chosen for this investigation as it is a widely employed example of an EED that uses a plastic plug. G.Y.

N79-15639# Dayton Univ. Research Inst., Ohio.
EDITING PROCEDURE FOR ANTHROPOMETRIC SURVEY DATA
Paul Kikta and Thomas Churchill Jul. 1978 138 p refs
(Contract F33615-77-C-0505)
(AD-A060393; AMRL-TR-78-38) Avail: NTIS HC A07/MF A01 CSCL 09/2

Described in this report are two computer programs designed to edit large masses of anthropometric survey data. The XVAL (eXtreme VALues) program scans for gross errors by sorting out the ten highest and ten lowest values in a given set of data for visual inspection. The EDIT (EDITing) program, a technique for sifting data more finely, tests each data point for each subject by comparing the measured value with a predicted value obtained from regression equations and flagging those which deviate from set limits. Detailed descriptions of input routines and computer output are liberally illustrated at every step. Instructions for the use of these programs are given to enable programmers to apply them to their own data. Computer printouts of the entire XVAL and EDIT programs, applied to actual data, are included as appendices. The authors emphasize the limitations of these programs by pointing out that however sophisticated the editing routines, they can only serve to discover, identify and flag possible errors. It is left to the experienced professional to confirm the deviant value as an error, assess its nature and decide whether to eliminate, correct or replace it. Author (GRA)

N79-15640# Michigan Univ., Ann Arbor. Highway Safety Research Inst.
WHOLE BODY RESPONSE RESEARCH PROGRAM Final Report, 1 Jul. 1973 - 31 Aug. 1977
Nabih M. Alem, John W. Melvin, Bruce M. Bowman, and Joseph B. Benson 25 Apr. 1978 122 p refs Sponsored in part by GM Res. Labs.
(PB-286151/6; UM-HSRI-77-39-1) Avail: NTIS HC A06/MF A01 CSCL 13L

Data were generated on the kinematics and response of human surrogates in a realistic automobile impact environment. The program used a test configuration consisting of an idealized hard seat representation of a car seat with a three-point harness restraint system. Three different severity levels of crash test conditions were used. The human surrogates tested in this program were fifteen male cadavers, a Hybrid Anthropomorphic Test Device and a Hybrid 3 ATD. In addition, mathematical simulations of the response and kinematics of a 50th percentile male occupant were performed at the three levels of crash severity, using the MVMA Two-Dimensional Crash Victim Simulator. GRA

N79-15641# Michigan Univ., Ann Arbor. Highway Safety Research Inst.
WHOLE BODY RESPONSE RESEARCH PROGRAM. APPENDIX A: METHODOLOGY Final Report, 1 Jul. 1973 - 31 Aug. 1977
N. M. Alem, J. B. Benson, G. L. Holstein, and J. W. Melvin 25 Apr. 1978 113 p refs Sponsored in part by GM Res. Labs.
(PB-286152/4; UM-HSRI-77-39-2) Avail: NTIS HC A06/MF A01 CSCL 13L

The following topics are discussed: (1) experimental procedures; (2) digital signal processing; (3) three-dimensional X-ray technique; (4) measurement of 3-D motion; and (5) fast algorithm for computing HIC (Head Injury Criterion). GRA

N79-15642# Michigan Univ., Ann Arbor. Highway Safety Research Inst.
WHOLE BODY RESPONSE RESEARCH PROGRAM. APPENDIX B: RAW DATA Final Report, 1 Jul. 1973 - 31 Aug. 1977
N. M. Alem 25 Apr. 1978 310 p refs Sponsored in part by GM Res. Labs.
(PB-286153/2; UM-HSRI-77-39-3) Avail: NTIS HC A14/MF A01 CSCL 13L

The appendix is organized in 11 data packages. Each of the first 9 packages is devoted to one cadaver. The 10th package is devoted to Part 572 ATD test series, and the last package contains previously unreported raw data. Each cadaver raw data package is divided into two or more groups of data sheets: the first group pertains to the description of the cadaver and the instrumentation as well as the thorax autopsy, while the remaining group(s) pertain to each test conducted on that cadaver, each of which contains a detailed set-up diagram and photographs, the filtered signals and a graphcheck of the test. GRA

N79-15643# Michigan Univ., Ann Arbor. Highway Safety Research Inst.
WHOLE BODY RESPONSE RESEARCH PROGRAM. APPENDIX C: PROCESSED DATA Final Report, 1 Jul. 1973 - 31 Aug. 1977
N. M. Alem 25 Apr. 1978 348 p refs Sponsored in part by GM Res. Labs.
(PB-286154/0; UM-HSRI-77-39-4) Avail: NTIS HC A15/MF A01 CSCL 13L

Detailed results of data processing consist of the graphical output of measured and computed accelerations, velocities and displacements as well as forces. For each test, a summary sheet is included which gives the peaks of all the variables and the times at which they occurred. GRA

N79-15644# General Accounting Office, Washington, D. C. Procurement and Systems Acquisition Div.
THE DEPARTMENT OF THE ARMY'S FOOD IRRADIATION PROGRAM: IS IT WORTH CONTINUING
29 Sep. 1978 58 p
(PB-286399/1; PSAP-78-146) Avail: NTIS HC A04/MF A01 CSCL 06H

In the last 25 years, the Department of Defense has spent $51 million on food irradiation research. The Army's food irradiation program is directed at using high doses of radiation to sterilize meats, thus preserving them from spoilage. The objective is to use irradiated meats in military rations. Despite the years of research, the Army has not yet convinced the Food and Drug Administration that the irradiated meats are safe and nutritious. Legal, scientific, and economic barriers must be dealt with before radiation sterilized meats can be used in military rations. GRA

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

N79-15645# Committee on Science and Technology (U. S. House).
EXTRATERRESTRIAL INTELLIGENCE RESEARCH
Washington GPO 1979 91 p Hearings before the Subcomm.

on Space Sci. and Applications of the Comm. on Sci. and Technol., 95th Congr., 2d Sess., No. 97, 19-20 Sep. 1978
(GPO-35-355) Avail: Subcomm. on Space Sci. and Applications

The hearings concerning space research for analyzing the radiation from space for evidence of intelligent life are reported. The history of attempts to establish extraterrestrial communications is reviewed. Problems of signal transmission and detection are discussed in terms of the long distance and resulting time for responses. F.O.S.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.
For components see *33 Electronics and Electrical Engineering.*

N79-15646# Maryland Univ., College Park. Computer Science Center.
ONE-WAY BOUNDED CELLULAR ACCEPTORS Interim Report
Charles R. Dyer Jul. 1978 46 p refs
(Grant AF-AFOSR-3271-77; AF Proj. 2304)
(AD-A060427; CSC-TR-680; AFOSR-78-1414TR) Avail: NTIS HC A03/MF A01 CSCL 09/2

The formal language recognition capabilities of one-dimensional one-way bounded cellular automata are studied. In particular, their relationships to real-time two-way bounded cellular acceptors, real-time iterative acceptors, real-time on-line multitape Turing acceptors, and one-way multihead finite acceptors are investigated. It is shown that the Dyck, linear, standard, and bracketed context-free languages are accepted in real-time by one-way bounded cellular acceptors. Author (GRA)

N79-15647# Mitre Corp., Bedford, Mass.
IMPLEMENTATION OF A SECURE DATA MANAGEMENT SYSTEM FOR THE SECURE UNIX OPERATING SYSTEM
B. N. Wagner Jul. 1978 41 p refs
(Contract F19628-78-C-0001; AF Proj. 5720)
(AD-A056902; MTR-3524; ESD-TR-78-154) Avail: NTIS HC A03/MF A01 CSCL 09/2

A secure data management system that achieved a multilevel capability for building and accessing relations was implemented to run on the Secure UNIX Operating System for DEC PDP-11/45. The secure DMS is an adaptation of INGRES. The effect of multilevel security on the design of the INGRES data base system and its user interface, including implementation details and an evaluation of the system is addressed. GRA

N79-15648# Command and Control Technical Center, Washington, D. C.
WORLDWIDE MILITARY COMMAND AND CONTROL SYSTEM (WWMCCS) H-6000 TUNING GUIDE. VOLUME 2: BATCH TURNAROUND TIME ANALYSES PROCEDURES
Barry M. Wallack and George H. Gero 5 Feb. 1978 168 p
(AD-A059938; AD-E100095; CCTC-TM-180-78-Vol-2) Avail: NTIS HC A08/MF A01 CSCL 09/2

The Federal Computer Performance Evaluation and Simulation Center (FEDSIM) developed a document for WWMCCS installations that can be used by site personnel to analyze the performance characteristics of their Honeywell 6000 (H-6000) computer systems. This document, called an H-6000 Tuning Guide, incorporates detailed analyses procedures that guide the analyst in applying specific techniques to improve system performance. This volume presents a set of procedures for analysis of batch job turnaround time. It first presents a model of the processes and queue points associated with batch job turnaround and then describes nine tests that use the model to direct the analysis of turnaround time. Author

N79-15649# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Sciences.
PERFORMANCE EVALUATION OF MULTIPLE PROCESSOR SYSTEMS Interim Report. Ph.D. Thesis
Levy Raskin Aug. 1978 238 p refs
(Contracts F44620-73-C-0074; N00014-77-C-0500; Grant NSF GJ-32758)
(AD-A060495; CMU-CS-78-141) Avail: NTIS HC A11/MF A01 CSCL 09/2

Technological trends in semiconductor and micro-processor development are clearly leading towards the production of a computer on a chip. In the near future such a computer module will include the equivalent of today's mini-computer with some memory. Connecting many computer-modules together will probably be a cost-effective way to build high performance computer systems. This thesis investigates and contrasts the performance of two multiple computer-module structures: a multiprocessor with shared memory and a local computer network in which all communication is via messages. Results are derived both from running benchmark applications and from performance models. Very little knowledge and experience has been gained on the performance of actual multiple processor applications. To investigate the problems and potential of these computer-module structures, a multiple processor system -- Cm** -- has been built. Firmware changes enable the emulation of both an efficient multiprocessor and a local computer network. Experiments were conducted on both types of structures to obtain performance information. Practical methodology includes measurement of performance parameters using a set of benchmark application programs executing on Cm**, and performance models that were derived and validated - using the measurement results - and then applied for the performance investigation. GRA

N79-15650# Command and Control Technical Center, Washington, D. C.
NMCS INFORMATION PROCESSING SYSTEM 360 FORMATTED FILE SYSTEM (NIPS 360 FFS). VOLUME 1: INTRODUCTION TO FILE CONCEPTS. USERS MANUAL
C. K. Hill Sep. 1978 155 p
(AD-A059033; CCTC-CSM-UM-15-78-Vol-1) Avail: NTIS HC A08/MF A01 CSCL 05/2

System concepts and system use are presented. A sample NIPS 360 FFS data file, the glossary of terms, and a description of the NIPS 360 FFS data file and file format table are shown. The NIPS 360 is the total system composed of the S/360 hardware and S/360 Operating System (OS) used to support NIPS 360 FFS software. S.E.S.

N79-15651# Command and Control Technical Center, Washington, D. C.
WORLDWIDE MILITARY COMMAND AND CONTROL SYSTEM (WWMCCS) H-6000 TUNING GUIDE. VOLUME 1: WWMCCS SYSTEM TUNING PROCESS
Barry M. Wallack and George H. Gero 3 Feb. 1978 54 p refs
(AD-A059937; AD-E100094; CCTC-TM-180-78-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 09/2

A document for WWMCCS installations was developed that can be used by site personnel to analyze the performance characteristics of their Honeywell 6000 computer systems. This tuning guide incorporates detailed analyses procedures that guide the analyst in applying specific techniques to improve system performance. The overall structure and application of the tuning guide are described. G.G.

N79-15652# McGill Univ., Montreal (Quebec). Dept. of Engineering.
AN EXPANDING AUTOMATION FOR USE IN STOCHASTIC

OPTIMIZATION Interim Report
Luc P. Devroye 1977 14 p refs
(Grant AF-AFOSR-2371-72)
(AD-A057668; AFOSR-78-1193TR) Avail: NTIS HC A02/MF A01 CSCL 09/2

A probabilistic automation with an expanding memory is presented. Its asymptotic properties as a stochastic optimization technique are studied. The procedure is shown to be convergent under very mild conditions on the statistical characteristics of the random environment. S.E.S.

N79-15653# Admiralty Surface Weapons Establishment, Portsmouth (England).
MODBUS: A STANDARD COMPUTER BUS STRUCTURE
T. D. Wells Feb. 1978 29 p refs
(AD-A059146; ASWE-TR-78003) Avail: NTIS HC A03/MF A01 CSCL 09/2

A bus standard for internal interfaces and closely-linked multi-processor type structures is detailed. The principle features of the standard and a method by which it may conveniently be applied using a custom built LSI chip set, are considered. The usage of the standard in a single-bus or non-linked configuration is emphasized. G.G.

N79-15654# Army Construction Engineering Research Lab., Champaign, Ill.
CLEARINGHOUSE INFORMATION SYSTEM: DESCRIPTION AND USER INSTRUCTIONS Final Report
R. D. Webster and Brenda Griffin Aug. 1978 17 p
(AD-A059176; CERL-TR-N-53) Avail: NTIS HC A02/MF A01 CSCL 09/2

The Clearinghouse Information System (CHIS), a computerized subsystem of the Environmental Technical Information System (ETIS) is developed. Users are provided with up-to-date listings of state, regional, or local clearinghouse agencies with which Federal agencies must coordinate new projects or activities. The information provided by these clearinghouses will prevent duplication of Federal and local efforts and insure compatibility of project planning. The user instructions and guidance for retrieving and using appropriate information to coordinate Department of the Army Environmental Impact Assessments and Environmental Impact Statements with state and local agencies are presented. S.E.S.

N79-15655# Pritsker and Associates, Inc., West Lafayette, Ind.
DOCUMENTATION FOR THE SAINT SIMULATION PROGRAM Final Report, Aug. 1975 - Dec. 1976
S. D. Duket, David B. Wortman, Deborah J. Seifert (Aerospace Med. Res. Lab., W-P AFB Ohio), Reuben L. Hann, and Gerald P. Chubb (Aerospace Med. Res. Lab., W-P AFB Ohio) Jun. 1978 145 p refs
(Contract F33615-76-C-5012)
(AD-A059198; AMRL-TR-77-63) Avail: NTIS HC A07/MF A01 CSCL 09/2

The overall structure and individual FORTRAN subprograms of SAINT (Systems Analysis of Integrated Networks of Tasks) are described. SAINT is a network modeling and simulation technique designed to aid the system designer and human engineer in analyzing complex man-machine systems. The conceptual framework is provided which allows the development of system models in which men, machines, and the environment are represented. S.E.S.

N79-15656# Technion - Israel Inst. of Tech., Haifa. Dept. of Biomedical Engineering.
TRACKING IN TWO DIMENSIONS AS A FUNCTION OF DIMENSION PRIORITIES AND TRACKING DIFFICULTY (II) Interim Report, 1 Oct. 1976 - 30 Sep. 1977
D. Gopher, David Navon, Nella Chillag, and Hana Dotan Dec. 1977 68 p refs
(Grant AF-AFOSR-3131-77)
(AD-A059206; AFOSR-78-1352TR) Avail: NTIS HC A04/MF A01 CSCL 09/2

Major issues in this study are the degree of voluntary control the operator has on his resources, his ability and willingness to meet demands set by the experimentor, and the extent to which resource allocation affects joint performance in various task combinations and different difficulty manipulations. An experiment is presented in which each of the dimensions (horizontal and vertical) in a two dimensional tracking task was treated as a separate time-shared task, and manipulated independently. Tracking accuracy was assessed under a joint manipulation of target frequency on each dimension and their relative priorities. Several interpretations for the results are discussed. The informativeness, human factors implications and possible applications of these functions are discussed for the evaluation, design and training of tracking tasks. G.Y.

N79-15657# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
THE SWITCHING STRUCTURE AND ADDRESSING ARCHITECTURE OF AN EXTENSIBLE MULTIPROCESSOR: Cm ASTERISK Ph.D. Thesis
Richard James Swan 9 Aug. 1978 235 p refs
(Contracts F44620-73-C-0074; N00014-77-C-0500; Grant NSF GJ-32758)
(AD-A060494; CMU-CS-78-138) Avail: NTIS HC A11/MF A01 CSCL 09/2

Cm* is an extensible, multiprocessor computer system with a hierarchical structure. A 10 processor pilot system, has been in operation for a year. The hardware structure will support on the order of 10,000 processors. A major overall design objective is to efficiently support close cooperation between large numbers of concurrently executing processes. An important component of multiprocessor systems is the switching structure which allows processors to access shared memory. The effective, maximum size (in number of processors) of multiprocessors described in the literature is limited. This limitation comes either through saturation of the access path to shared memory, or through the rapid growth of switch cost. The hierarchical switching structure of Cm* offers, in principle, indefinite extensibility of processing power, memory capacity and communication bandwidth. The cost of the interconnection structure grows approximately linearly with system size. Effective use of the structure depends on suitable decompositions of applications. GRA

N79-15658# Army Communications Research and Development Command, Fort Monmouth, N. J. Center for Tactical Computer Systems.
A COMPARISON OF THE EXISTING SUPPORT SOFTWARE BASES OF THE AN/GYQ-21
James Wagner and H. Stone Jul. 1978 79 p refs
(DA Proj. 1L1-62701-AH-92)
(AD-A060944; CORADCOM-78-10) Avail: NTIS HC A05/MF A01 CSCL 09/2

A comparison of the support software bases of the four currently utilized military architectures and the AN/GYQ-21 (DEC PDP-11) is described. Approach taken in this evaluation is to model the software development process, hypothesize an ideal support software structure for the model and then apply that structure against each of the architectures in turn. The support software available for each architecture can then be listed and by estimating the development cost of each tool, the total software bases and deficiencies in dollars of each architecture determined. This evaluation is one of the major inputs to a life cycle cost analysis, reported separately, of 78 Army/Navy military computer based systems which attempts to determine the cost-effective approach to standardization of computer architectures. GRA

N79-15659# Army Missile Research and Development Command, Redstone Arsenal, Ala. Technology Lab.
EVALUATION OF DATA GENERATOR FOR THREAD/PROGRAM UNIT TESTING
Charles L. Lewis, Farley W. Spruell, and Wayne L. Jones 28 Jun. 1978 46 p refs
(AD-A060409; DRDMI-T-78-64) Avail: NTIS HC A03/MF A01 CSCL 09/2

This report documents the results of a study to determine the feasibility of utilizing actual field test data or other hardware related test data stored on Mission Recording Tapes (MRT's) to develop an Environment Generator (ENVGEN) data set for WCC software testing. Two representative program units (BIDR and SAPB) were evaluated. Results indicated that while some programs units can be successfully tested with MRT-based ENVGEN data (i.e., SAPB), the wide variations in data collected on MRT's and the input requirements of the various threads/

program units make it unfeasible to develop a computer program which automatically creates the ENVGEN data set. MRT data retrieval and SAPB software test computer program listings are included. Author (GRA)

N79-15660# Ohio State Univ., Columbus. Dept. of Computer and Information Science.
ESTIMATION OF RUN TIMES USING SIGNATURE TABLE ANALYSIS Final Report, 1 Aug. 1977 - 31 Aug. 1978
Sandra A. Mamrak and Paul D. Amer Jun. 1978 12 p
(Grant DAAG29-77-G-0185)
(AD-A060492; ARO-15249.1-EL) Avail: NTIS HC A02/MF A01 CSCL 09/2

Algorithms for managing jobstreams in a complex computer environment often rely on various estimates of job run times. Due to wide variability of run times from one execution of a job to another, point estimations of run times are fairly unreliable. An alternate approach to using point estimations is to use intervals which span the range of possible run time values. In an interval approach run times can be predicted with respect to membership in one of a limited set of run time intervals, with relatively high confidence. This paper presents a formal methodology for run time estimation based on an interval approach. The estimation is done using signature table analysis and is accompanied by a statement of statistical confidence in the results. Author (GRA)

N79-15661# Michigan Univ., Ann Arbor. Systems Engineering Lab.
A CRAY-1 CROSS ASSEMBLER Interim Report
W. G. Ames 1 Sep. 1978 38 p
(Grant AF-AFOSR-2812-75)
(AD-A060414; SEL-120; AFOSR-78-1406TR) Avail: NTIS HC A03/MF A01 CSCL 09/2

A CRAY-1 cross assembler is described. It is written in FORTRAN, and developed on an Amdahl 470/V6. The source code accepted is very close to that of the CRAY Research assembler, and the object code produced is compatible with the University of Michigan CRAY-1 simulator. The assembler and simulator form a powerful tool for developing assembly language programs. Author (GRA)

N79-15662# Air Force Weapons Lab., Kirtland AFB, N. Mex.
FOURTH GENERATION COMPUTER ARCHITECTURES Final Report
Gerald W. Brezina Oct. 1978 108 p
(AD-A060670; AD-E200129; AFWL-TR-77-190) Avail: NTIS HC A06/MF A01 CSCL 09/2

The architecture of the computer central processor holds the key to increasing speed of operation after electronic transmission lines rates become a limiting factor. The serial processor was the first and simplest type of central processor, and although many of today's machines appear to have their own unique architectures, their processors are, in most cases, only combinations of three architectural types: (1) concurrent; (2) parallel; and (3) pipeline. The Texas Instruments Advanced Scientific Computer (TI-ASC) can be configured to form up to four parallel arithmetic pipelines with each pipeline constructed of eight segments. It has a cycle time of 80 ns. The CRAY Research CRAY-1 is a concurrent pipeline computer with 12 independent functional units. It has a cycle time of 12.5 ns. The Control Data STAR-100 is also a concurrent pipeline computer which operates upon string and arrays of data. It has a cycle time of 40 ns. Author (GRA)

N79-15663# Rockwell International Corp., Anaheim, Calif. Electronics Research Center.
HIGH DENSITY MAGNETIC BUBBLE MEMORY TECHNIQUES Interim Report, 4 May - 4 Nov. 1977
P. J. Besser, D. M. Heinz, T. Kobayashi, T. T. Chen, and L. R. Tocci Wright Patterson AFB, Ohio AFAL Mar. 1978 61 p refs
(Contract F33615-76-C-1198; AF Proj. 2305)
(AD-A060715; C76-845.16/501; AFAL-TR-78-31) Avail: NTIS HC A04/MF A01 CSCL 09/2

The objective of this basic research effort is to demonstrate the feasibility of a new technology for all solid state large data base memories for airborne/spaceborne applications. The program scope is limited to demonstrating the feasibility of the device functions and bit density capabilities required to meet the system goals. It is the objective of this program to advance one technology into development. Based on an evaluation of the present and potential capabilities of candidate solid state technologies to meet the system goals, magnetic bubble domain technology has been selected as the one to be pursued on this program. The proposed approach makes use of small bubble materials, multilayer, self-biased materials and devices, wafer level integration using hybrid chip designs and fineline lithographic techniques for device fabrication. The effort on small bubble materials research was devoted to: (1) extending the useful temperature range of the 2 micrometers and 1 micrometer bubble diameter materials which were developed in the previous report internal, (2) investigating film growth on 76 mm dia substrates, and (3) demonstrating the capabilities of the materials by device operation. With the successful accomplishment of the above three tasks the small bubbles portion of the materials research effort has been concluded. Materials research has concentrated on the means for improving the performances of self-biased bubble films and on an alternate to CaGe substitution in bubble films. GRA

N79-15664# Naval Research Lab., Washington, D. C.
REMOTE TERMINAL PLOTTER CONTROLLER Final Report
John C. Moore 17 May 1978 16 p
(RR0310143)
(AD-A060737; AD-E000213; NRL-8217) Avail: NTIS HC A02/MF A01 CSCL 17/2

A remote terminal incremental plotter controller operating within the restrictions of narrow bandwidth telephone lines is described. The device, with minor modifications, will operate nearly all incremental plotters from any computer large enough to hold a software plot package and having a teletypewriter or time-share output. The heart of the device is a National SC/MP microprocessor kit. A patent application covering this device has been submitted under Navy Case 61,576. Author (GRA)

N79-15665# General Electric Co., Pittsfield, Mass.
CHARACTERIZATION OF COMPLEX MICROPROCESSORS AND SUPPORT CHIPS Final Technical Report, Dec. 1976 - Jan. 1978
T. M. Ostrowski Griffiss AFB, N.Y. RADC Jun. 1978 275 p
(Contract F30602-77-C-0012; AF Proj. 2338)
(AD-A057079; RADC-TR-78-138) Avail: NTIS HC A12/MF A01 CSCL 09/2

Semiconductor microprocessors and their support devices were electrically characterized over the defined military temperature range of -55 C to +125 C. This included assurance that the devices studied met established military standards, were technically accurate and electrically complete. This effort concentrated on final vendor negotiations of the 8080A and 6800 microprocessor detail M38510 specifications. This resulted in the JAN qualification of the Intel Corp as a source for the 8080A and Motorola Semiconductor as a source for the 6800. Major emphasis was also placed on electrically characterizing the 2900 bit-slice microprocessor and its support devices. Finally, the general problem area of testing a tristate output was evaluated resulting in an effective load network applicable to all tristate outputs. This network replaces several relays and other components thus saving the vendor test cost, time and providing a more reliable test panel. J.M.S.

N79-15666# National Technical Information Service, Springfield, Va.
SHIFT REGISTERS. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Nov. 1978
Brian Carrigan Nov. 1978 212 p Supersedes NTIS/PS-77/1090; NTIS/PS-76/1003; NTIS/PS-75/879
(NTIS/PS-78/1203/5; NTIS/PS-77/1090; NTIS/PS-76/1003; NTIS/PS-75/879) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 09B

Research is reported on the design, development, and application of shift registers. Studies are included on linear sequence generators, pseudorandom generators, feedback shift registers, and ferrite diode shift registers. Coding and decoding of shift registers are included. This updated bibliography contains 207 abstracts, 19 of which are new entries to the previous edition. GRA

N79-15667# National Technical Information Service, Springfield, Va.
PRINTERS. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Nov. 1978
Brian Carrigan Nov. 1978 178 p Supersedes NTIS/PS-77/1099; NTIS/PS-76/1000; NTIS/PS-75/865
(NTIS/PS-78/1218/3; NTIS/PS-77/1099; NTIS/PS-76/1000; NTIS/PS-75/865) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 09B

Computer printers, contact printers, projection printers, and microfilm reader-printers are described. Studies are included on the use of these printers in computer graphics, aerial photography, cartography, and data processing. This updated bibliography contains 172 abstracts, 13 of which are new entries to the previous edition. GRA

N79-15668# Missouri Univ. - Columbia. Health Services Research Center/Health Care Technology Center.
MICROPROCESSOR TECHNOLOGY: IMPLICATIONS FOR CONTINUING EDUCATION IN THE HEALTH PROFESSIONS
John D. Simpkins, William McFarland, Gregory N. Larsen, Donald J. Brenner, and Donald A. B. Lindberg Mar. 1978 77 p refs (Grants HS-02569; M8-00188-02; LM-07006-2ITI5)
(PB-286348/8; UMC/HCTC/D-002) Avail: NTIS HC A05/MF A01 CSCL 05I

The academic and research oriented formal programs in continuing education are found to be substantially lagging the developments in commerce. Even the programs overtly committed to computer aided instruction (CAI) in medicine appear substantially rooted in the now aging technology of large time sharing central computers. A determined move now on the part of medical educators could change the course of the technology flow to benefit patients and the health professions. Action is needed to orient formal CAI programs toward continuing medical education (CME) and to orient the CME programs somewhat more strongly toward personal computer. GRA

N79-15669# National Technical Information Service, Springfield, Va.
DATA COMPRESSION. CITATIONS FROM THE NTIS DATA BASE Progress Report, Dec. 1964 - Nov. 1978
Brian Carrigan Dec. 1978 224 p Supersedes NTIS/PS-77/1129; NTIS/PS-76/0995; NTIS/PS-75/860; NTIS/PS-75/067 (NTIS/PS-78/1247/2; NTIS/PS-77/1129; NTIS/PS-76/0995; NTIS/PS-75/860; NTIS/PS-75/067) Avail: NTIS HC $28.00/MF $28.00 CSCL 09B

The bibliography cites Government-sponsored research studies on techniques and equipment for data compression. Reports are included on video communications, telemetry, voice communications, data management, and computer storage devices. (This updated bibliography contains 218 abstracts, 26 of which are new entries to the previous edition.) GRA

N79-15670# National Technical Information Service, Springfield, Va.
DATA COMPRESSION. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Nov. 1978
Brian Carrigan Dec. 1978 281 p Supersedes NTIS/PS-77/1130; NTIS/PS-76/0996
(NTIS/PS-78/1248/0; NTIS/PS-77/1130; NTIS/PS-76/0996) Avail: NTIS HC $28.00/MF $28.00 CSCL 09B

The bibliography of worldwide journal literature cites research on techniques and equipment for data compression. Reports on video communications, data management, and computer storage devices are included. (This updated bibliography contains 276 abstracts, 36 of which are new entries to the previous edition.) GRA

N79-15671# National Technical Information Service, Springfield, Va.
RANDOM ACCESS MEMORIES. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Nov. 1978
Brian Carrigan Nov. 1978 196 p Supersedes NTIS/PS-77/1100; NTIS/PS-76/0997; NTIS/PS-75/811
(NTIS/PS-78/1221/7; NTIS/PS-77/1100; NTIS/PS-76/0997; NTIS/PS-75/811) Avail: NTIS HC $28.00/MF $28.00 CSCL 09B

A bibliography containing 27 abstracts concerning research reports on the design, development, and application of random access storage devices and materials is presented. Studies are included on wall placement techniques, domain wall observations, microcircuitry, and software development. GRA

N79-15672# National Technical Information Service, Springfield, Va.
RANDOM ACCESS MEMORIES. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1974 - Nov. 1978
Brian Carrigan Nov. 1978 290 p Supersedes NTIS/PS-77/1111; NTIS/PS-76/0998
(NTIS/PS-78/1222/5; NTIS/PS-77/1111; NTIS/PS-76/0998) Avail: NTIS HC $28.00/MF $28.00 CSCL 09B

A bibliography containing 286 abstracts concerning research on the design, development, and application of random access computer storage devices is presented. Research on charge coupled devices in random access storage, random access memories in microprocessor applications, and reliability of random access memories are included. GRA

N79-15673# Mathematics and Computation Lab., Washington, D. C. Information Science Div.
INFORMATION MANAGEMENT SYSTEM REFERENCE MANUAL Final Report
Edgar M. Cagley, David L. Parrish, Nathan J. Ray, and Richard H. Vaughn Sep. 1978 154 p Revised
(PB-286832/1; GSA/FPA/MCL-TM-208-Rev-5) Avail: NTIS HC A08/MF A01 CSCL 09B

IMS is a user-oriented information management system which facilitates the manipulation of data files on the Univac 1100 Series Computing Equipment, operating under standard releases of the operating system. A query language based on a keyword concept and a random access technique that allows for rapid on-line updating as well as retrieval of data is featured. A file definition facility that allows users to associate meaningful names with data fields and subsequently to manipulate the data by using the associated names as variables is provided. A report facility and a report generator are presented. GRA

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N79-15674*# Aerospace Corp., El Segundo, Calif. Advanced Programs Div.
THE DETERMINATION OF MEASURES OF SOFTWARE RELIABILITY Final Report
F. D. Maxwell and B. C. Corn Dec. 1978 118 p refs (Contract NAS1-14392)
(NASA-CR-158960; ATR-79(7590)-1) Avail: NTIS HC A06/MF A01 CSCL 09B

Measurement of software reliability was carried out during the development of data base software for a multi-sensor tracking system. The failure ratio and failure rate were found to be consistent measures. Trend lines could be established from these measurements that provide good visualization of the progress on the job as a whole as well as on individual modules. Over one-half of the observed failures were due to factors associated with the individual run submission rather than with the code proper. Possible application of these findings for line management, project managers, functional management, and regulatory agencies is discussed. Steps for simplifying the measurement process and for use of these data in predicting operational software reliability are outlined. Author

N79-15675*# Essex Corp., Huntsville, Ala.
DEVELOPMENT OF USER GUIDELINES FOR ECAS DISPLAY DESIGN, VOLUME 1 Final Report
Daniel W. Dodson and Nicholas L. Shields, Jr. 8 Nov. 1978 29 p ref
(Contract NAS8-32991)

(NASA-CR-150877; H-78-04-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 09B

Experiment computer application software (ECAS) display design and command usage guidelines were developed, which if followed by spacelab experiments, would standardize methods and techniques for data presentation and commanding via ECAS. These guidelines would provide some commonality among experiments which would enhance crew training and flight operations. The guidelines are applicable to all onboard experiment displays, whether allocated by ECAS or a dedicated experiment processor. A brief description of the spacelab data display system characteristics and of the services provided by the experiment computer operating system is included. Guidelines concerning data presentation and layout of alphanumeric and graphic information are presented along with guidelines concerning keyboard commanding and command feedback. B.B.

N79-15676*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
STANDARDIZED DEVELOPMENT OF COMPUTER SOFTWARE. PART 2: STANDARDS
Robert C. Tausworthe Aug. 1978 559 p refs
(Contract NAS7-100)
(NASA-CR-158070; JPL-SP-43-29-PT-2) Avail: NTIS HC A24/MF A01 CSCL 09B

This monograph contains standards for software development and engineering. The book sets forth rules for design, specification, coding, testing, documentation, and quality assurance audits of software; it also contains detailed outlines for the documentation to be produced. G.G.

N79-15677# Michigan Univ., Ann Arbor. Systems Engineering Lab.
A CRAY-1 SIMULATOR Interim Report
D. A. Orbits 1 Sep. 1978 124 p
(Grant AF-AFOSR-2812-75; AF Proj. 2304)
(AD-A060638; UMICH-SEL-118; AFOSR-78-1405TR) Avail: NTIS HC A06/MF A01 CSCL 09/2

A CRAY-1 logic-timing simulator is described. This simulator is written in FORTRAN-IV on an IBM 360/370 series machine. The simulator provides extensive reporting of CRAY-1 resource usage and resource conflicts. By calling the simulator as a subroutine, the user may flexibly use CRAY-1 program simulation within a larger problem environment. Extensive interactive debugging features make the CRAY-1 simulator a powerful tool for the development of CRAY-1 assembly language programs. Author (GRA)

N79-15678# Naval Training Analysis and Evaluation Group, Orlando, Fla.
ANALYSIS OF SOFTWARE SIMULATION IN COMPUTER-BASED ELECTRONIC EQUIPMENT MAINTENANCE TRAINERS Final Report
Ted E. Pearson and Edward O. Moore, Jr. Sep. 1978 76 p refs
(AD-A060583; TAEG-57) Avail: NTIS HC A05/MF A01 CSCL 09/3

This study assessed the current and future application of computers in electronic equipment maintenance training devices. Emphasis was placed on examining computer software simulation techniques for generating emulations of electronic equipment front panel and internal circuit static and dynamic operational characteristics. The report does not present a formal review of the state-of-the-art in electronic equipment maintenance training devices. However, much of the relevant literature was organized and reviewed; a bibliography of source documents is appended to the report. Author (GRA)

N79-15679# Stanford Univ., Calif. Dept. of Operations Research.
GENERALIZED COVERING RELAXATION FOR 0-1 PROGRAMS
Daniel Granot and Frieda Granot Jun. 1978 25 p refs
(Contract N00014-76-C-0418)
(AD-A060851; SU-TR-79) Avail: NTIS HC A02/MF A01 CSCL 12/1

A general purpose algorithm is constructed for solving polynomial 0-1 programming problems. The algorithm is applied directly to the polynomial problem in its original form. Further, no additional variables are introduced in the solution process. The algorithm was tested on randomly generated modest size problems and the preliminary computational results obtained are very encouraging. GRA

N79-15680# Naval Surface Weapons Center, Dahlgren, Va.
MODULAR WEAPON SYSTEM SIMULATION SOFTWARE DESIGN AND OPERATION REQUIREMENTS Final Report
Wayne McLaughlin Sep. 1978 56 p refs
(AD-A060915; NSWC/DL-TR-3874) Avail: NTIS HC A04/MF A01 CSCL 15/3

The program uses a simplified three-degree-of-freedom trajectory representation, and is comprised of modular elements, whose actual breakdown scheme is based on both independent functional operation and susceptibility to future change. The use of state-of-the-art structured programming techniques has enabled this design method to be effectively executed. Additionally, a load time option resolution utility has been developed and implemented, which results in greater execution efficiency and improved utilization of computer memory resources. This feature has been interfaced with a general purpose input processor software package, resulting in simplified user input which can conveniently undergo slight alterations during a multiple flight run. The complete system is under the jurisdiction of an automated control card procedure facility, which controls execution of all portions of the model, and reduces the number of control cards which must be prepared by the user to a minimum. GRA

N79-15681# Naval Ocean Systems Center, San Diego, Calif.
PASCAL 1100: AN IMPLEMENTATION OF THE PASCAL LANGUAGE FOR UNIVAC 1100 SERIES COMPUTERS Research and Development Report, Oct. 1976 - Sep. 1977
M. S. Ball 1 Jul. 1978 27 p
(AD-A059861; NOSC/TR-271) Avail: NTIS HC A03/MF A01 CSCL 09/2

Only those features of the language that are peculiar to the Univac implementation are described. The PASCAL compiler is also capable of compiling programs written in a PASCAL dialect used in a minicomputer-based implementation of the language. Those features related to this implementation are always available to the user but are not generally available on other PASCAL implementations. GRA

N79-15682# Inco, Inc., McLean, Va.
STANDARD SOFTWARE BASE (SSB) RELEASE 3 Final Technical Report, 26 Aug. 1976 - 28 Feb. 1978
Thomas Trump Jul. 1978 72 p
(Contract F30602-77-C-0046)
(AD-A059647; INCO/1073-378-TR-26-D(F); RADC-TR-78-167) Avail: NTIS HC A04/MF A01 CSCL 09/2

The Standard Software Base (SSB) was developed to provide a common inventory of modular software tools with which AN/GYQ-21(V) system users could quickly and effectively develop and implement data systems unique to their site-specific requirements. The specific objectives of the SSB system include: (1) Establishment of a common standard technological software base supporting the development of applications programs, and overall implementation of AN/GYQ-21(V) systems. (2) Elimination of duplicate development efforts and shortening implementation schedules. (3) Development and delivery of comprehensive system documentation and software releases to user activities. (4) Development of a comprehensive training program to equip Air Force personnel with the knowledge required to develop mobile on-site SSB training teams. Author

N79-15683# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
GRAPHICS COMPATIBILITY SYSTEM (GCS): PRIMER ON COMPUTER GRAPHICS PROGRAMMING
1978 479 p Revised
(AD-A059923) Avail: NTIS HC A21/MF A01 CSCL 09/2

Graphics Compatability System (GCS) is a FORTRAN-based computer graphics system designed for interactive use on a wide variety of computer graphics terminals. GCS's capabilities range over a powerful set of functions. It can produce a simple line drawing (with over 40 types of lines), or handle comprehensive general-purpose axis-creation and automatic clipping; ARC and

Conic generation; graphic input; drafting multilevel, secondary-coordinate system definition and characters; and italicized software characters. All plotting and other positional output can be done in the user's own units without his having to know anything about the specific nature of his terminal. G.Y.

N79-15684# Stanford Univ., Calif.
DIRECTLY EXECUTED LANGUAGES Final Report, 15 Jul. 1975 - 14 Jul. 1978
Michael J. Flynn Sep. 1978 8 p refs
(Grant DAAG29-76-G-0001)
(AD-A059968; ARO-12958.11-EL) Avail: NTIS HC A02/MF A01 CSCL 09/2

The research addressed two important issues in the design of optimal languages for direct execution in an interpretive system: binding the operand identifiers in an executable instruction unit to the arguments of the routine implementing the operator defined by that instruction; and binding operand identifiers to execution variables. These issues are central to the performance of a system, both in space and time. The report summarizes the results of this study. Author

N79-15685# Digital Technology, Inc., Champaign, Ill.
INFE SOFTWARE FUNCTIONAL DESCRIPTION OVERVIEW
Gary R. Grossman, Steven F. Holmgren, and Richard H. Howe 20 Mar. 1978 38 p
(Contract DCA100-77-C-0069)
(AD-A060667; AD-E100081; DTI-2) Avail: NTIS HC A03/MF A01 CSCL 09/2

Digital Technology Incorporated is developing an IOC Network Frontend (INFE) to connect a WWMCCS H6000 to AUTODIN II. A DEC PDP-11/70 running under a modified Network UNIX system is being used for the INFE. This document describes the data routes through the INFE, the INFE protocol modules, and the flow of data vis-a-vis protocol staging in the INFE. Author (GRA)

N79-15686# Digital Technology, Inc., Champaign, Ill.
INFE PROGRAM DESIGN SPECIFICATIONS. PHASE B. NFE SOFTWARE PROGRAM DESIGN SPECIFICATIONS
Steven F. Holmgren, David C. Healy, and David A. Wilcox 15 May 1978 116 p
(Contract DCA100-77-C-0069)
(AD-A060668; AD-E100082; DTI-6) Avail: NTIS HC A06/MF A01 CSCL 09/2

Digital Technology Incorporated is developing an IOC Network Frontend (INFE) to connect a WWMCCS H6000 to AUTODIN II. A DEC PDP-11/70 running under a modified Network UNIX system is being used for the INFE. This document contains the program design specifications for the AUTODIN II protocol software used in the INFE. Author (GRA)

N79-15687# Wisconsin Univ. - Madison. Mathematics Research Center.
LANGUAGE REQUIREMENTS AND DESIGN TO AID DATA ANALYSIS AND STATISTICAL COMPUTING
Graham N. Wilkinson Jun. 1978 21 p refs
(Contract DAAG29-75-C-0024)
(AD-A060719; MRC-TSR-1857) Avail: NTIS HC A02/MF A01 CSCL 09/2

An outline is given of design requirements for high-level statistical computing languages, with special emphasis on nameable data-structures, general operations including matrix and table calculations, looping, branching and the use of macros, and on user-extendability. Implementation and evaluation are discussed briefly. Author (GRA)

N79-15688# Michigan Univ., Ann Arbor. Dept. of Industrial and Operations Engineering.
USER REQUIREMENTS ANALYZER (URA) USER'S MANUAL H6180/MULTICS/VERSION 3.3 Technical Report, Aug. 1977 - Jan. 1978
Jul. 1978 595 p refs
(Contract F19628-76-C-0197; AF Proj. 2237)
(AD-A060517; ESD-TR-78-131) Avail: NTIS HC A25/MF A01 CSCL 09/2

This report is part of a series that deals with a Computer-Aided Design and Specification Analysis Tool (CADSAT). The purpose of the tool is to describe the requirements for information processing systems and to record such descriptions in machine processable form. The major components of CADSAT are the User Requirements Language (URL) and the User Requirements Analyzer (URA) which can operate in an interactive computer environment. This report describes the capabilities and the commands associated with URA and its operation on a Honeywell 6180 Multics Computer. Author (GRA)

N79-15689# Science Applications, Inc., Englewood, Colo.
COGNITIVE STRUCTURES IN THE COMPREHENSION AND MEMORY OF COMPUTER PROGRAMS: AN INVESTIGATION OF COMPUTER PROGRAM DEBUGGING Technical Report, 12 Jul. 1956 - 11 Nov. 1977
Michael E. Atwood and H. Rudy Ramsey Aug. 1978 91 p refs
(Contract DAHC19-76-C-0040)
(AD-A060522; SAI-78-054-DEN; ARI-TR-78-A21) Avail: NTIS HC A05/MF A01 CSCL 09/2

A theoretical framework, based upon recent studies in cognitive psychology on memory for text, was developed to explain certain aspects of human behavior during computer program comprehension and debugging. A central concept of this framework is that the information contained in a program is represented in a programmer's memory as a connected, partially ordered list (hierarchy) of 'propositions' (units of information with properties similar to those observed in research on text memory). An experiment was performed to test the hypothesis that the difficulty in finding a program bug is a function of the bug's location in this hierarchy. This experiment compared the effects of bug location, bug type (array, iteration, assignment) and specific program. Each of 48 subjects debugged two separate programs, with one type of bug at two different hierarchical levels in each program. A preliminary analysis suggested that all three factors -- program, bug type, and bug location. - significantly affected the time required to locate program bugs. Detailed analyses, however, suggested the program and bug type variables could be explained in terms of the bug location variable and the A bug's location in A program's underlying propositional hierarchy as a principal factor affecting performance in a comprehension and debugging task. Author (GRA)

N79-15690# Ballistic Research Labs., Aberdeen Proving Ground, Md.
DEFORMATION PLOTTING PROGRAMS FOR THE EPIC FINITE ELEMENT CODES Final Report
B. E. Ringers Aug. 1978 74 p refs
(DA Proj. 1L1-62618-AH-80)
(AD-A060673; AD-E430113; ARBRL-TR-02096) Avail: NTIS HC A04/MF A01 CSCL 09/2

This report describes deformation plotting routines written to handle output generated by two and three dimensional Epic finite element codes. The output contains the nodes which define each triangular or tetrahedral element and the nodal coordinates. Documentation is included detailing usage of these programs. Author (GRA)

N79-15691# Wisconsin Univ. - Madison. Mathematics Research Center.
ON THE DEVELOPMENT OF OPTIMIZATION THEORY
Andras Prekopa Apr. 1978 39 p refs
(Contract DAAG29-75-C-0024)
(AD-A060618; MRC-TSR-1842) Avail: NTIS HC A03/MF A01 CSCL 12/1

The method of Lagrange for finding extrema of functions subject to equality constraints was published in 1788 in the famous book Mecanique Analytique. The works of Karush, John, Kuhn and Tucker concerning optimization subject to inequality constraints appeared more than 150 years after that. The purpose of this paper is to call attention to important papers, published as contributions to mechanics, containing fundamental ideas concerning optimization theory. The most important works in this respect were done primarily by Fourier, Cournot, Farkas and further by Gauss, Ostrogradsky and Hamel. Author (GRA)

N79-15692# Stanford Univ., Calif. Systems Optimization Lab.

A SURVEY OF AVAILABLE SOFTWARE FOR NONLINEARLY CONSTRAINED OPTIMIZATION
Margaret H. Wright Jan. 1978 29 p refs Sponsored in part by DOE and NSF
(Contracts N00014-75-C-0865; DAAG29-74-C-0034; EY-76-S-03-0326-PA-18) Grants NSF MCS-76-20019; NSF ENG-77-06761;
(AD-A060818; SOL-78-4) Avail: NTIS HC A03/MF A01 CSCL 12/1

The aim of this paper is to present a brief overview of current practice in solving nonlinearly constrained optimization problems. First, we consider selected theoretical and computational aspects of some of the widely used methods for such problems. Second, the status of implementations of such methods will be sketched. The latter discussion will include: factors to be considered in evaluating optimization programs; guidelines concerning the application of a general-purpose routine to any particular problem; and a list of some available software.
Author (GRA)

N79-15693# Maryland Univ., College Park. Computer Science Center.
CELLULAR GRAPH ACCEPTORS, 5: CLOSURE PROPERTIES OF CELLULAR D-GRAPH LANGUAGES Interim Report
Angela Wu Jul. 1978 31 p refs
(Grant AF-AFOSR-3271-77; AF Proj. 2304)
(AD-A060380; TR-681; AFOSR-78-1372TR) Avail: NTIS HC A03/MF A01 CSCL 09/4

Cellular d-graph languages are shown to be closed under set theoretic operations, including finite union and intersection; and under geometric operations, including permutation of arc end numbering, concatenation, closure, and formation of line graphs. Determinism is preserved under the set-theoretic operations; but under the geometric operations, determinism is known to be preserved only when the languages are also predicates.
Author (GRA)

N79-15694# Digital Technology, Inc., Champaign, Ill.
PHASE B EXPERIMENT PLAN
19 Jun. 1978 12 p refs
(Contract DCA100-77-C-0069)
(AD-A060669; AD-E100083; DTI-7) Avail: NTIS HC A02/MF A01 CSCL 09/2

Digital Technology Incorporated is developing an IOC Network Front End (INFE) to connect a WWMCCS H6000 to AUTODIN II. A DEC PDP-11/70 running under a modified Network UNIX system is being used for the INFE. This document presents the experiments to be performed on the INFE and their rationale.
Author (GRA)

N79-15695# Rice Univ., Houston, Tex. Dept. of Mechanical and Aerospace Engineering and Materials Science.
GRADIENT ALGORITHMS FOR THE OPTIMIZATION OF DYNAMIC SYSTEMS Interim Report
Angelo Miele 1978 82 p refs Submitted for publication
(Grants AF-AFOSR-3075-76; NSF MCS-76-21657; AF Proj. 2304)
(AD-A060641; AP-16; AFOSR-78-1399TR) Avail: NTIS HC A06/MF A01 CSCL 21/1

Recent advances in the area of gradient methods for optimal control problems are reviewed. Single-subarc problems are treated. Specifically, two classes of optimal control problems, called Problem P1 and Problem P2 are considered. Problem P1 consists of minimizing a functional 1 which depends on the n-vector state x(t), the m-vector control u(t), and the p-vector parameter pi. Problem P2 enlarges dramatically the number and variety of problems of optimal control which can be treated by gradient-restoration algorithms. Eight numerical examples are presented to illustrate the performance of the algorithms associated with Problem P1 and Problem P2. The numerical results show the feasibility as well as the convergence characteristics of these algorithms.
GRA

N79-15696# Naval Research Lab., Washington, D. C. Applied Mechanics Branch.
PERFORMANCE OF THE TRANSITION ANALYSIS PROGRAM SYSTEM ON THE ADVANCED SCIENTIFIC COMPUTER Interim Report
R. J. Hansen Aug. 1978 11 p
(RR0230141)
(AD-A060665; NRL-MR-3812) Avail: NTIS HC A02/MF A01 CSCL 09/2

The Transition Analysis Program System (TAPS) has been implemented on the Advanced Scientific Computer (ASC) at NRL. No changes in the original program have been made to take advantage of the pipeline architecture of the ASC, but some vectorization of the code is performed by the computer. Comparisons of computational results, run times, and costs of flow problems solved with TAPS on the ASC and other computational facilities are presented and their significance discussed.
Author (GRA)

N79-15697# Carnegie-Mellon Univ., Pittsburgh, Pa. Management Sciences Research Group.
FUNCTIONS FOR MEASURING THE QUALITY OF APPROXIMATE SOLUTIONS TO ZERO-ONE PROGRAMMING PROBLEMS
Eitan Zemel Jun. 1978 28 p refs Revised
(Contract N00014-75-C-0621; Grant NSF MPS-73-08534)
(AD-A060651; MSRR-422-Rev) Avail: NTIS HC A03/MF A01 CSCL 12/1

The difficulties associated with measuring the solutions are defined of an approximate (heuristic) solution by 'Percentage-Error' as is customary. A set of properties that are to be expected from a proper measure of solution quality are defined and the family of functions which satisfy those conditions are investigated. In particular, it is shown that for any class of 0-1 programming problems appropriate functions do exist and that they are uniquely defined up to monotone transformations. Several examples of linear functions which are suitable for certain classes of problems are included.
GRA

N79-15698# California Univ., San Diego. Computer Science Div.
QM-1 MULTI MICRO-PROGRAMMER GUIDE Final Report
W. A. Burkard, R. D. Tuck, and R. L. Hartung Sep. 1978 98 p refs
(Contract N60921-77-M-B785)
(AD-A060639; NSWC/DL-TR-3834) Avail: NTIS HC A05/MF A01 CSCL 09/2

MULTI is a vertical micro-programming instruction set for the Nanodata QM-1 computer. It has been used to write computer emulations, an operating system kernal, and intermediate language machines. This document was written to serve as a reference manual for micro-programmers. It defines a standard programming environment for micro-programming the Nanodata QM-1 computer.
Author (GRA)

N79-15699# Stanford Univ., Calif. Dept. of Operations Research.
LEAST-INDEX RESOLUTION OF DEGENERACY IN QUADRATIC PROGRAMMING
Yow-Yieh Chang and Richard W. Cottle Feb. 1978 22 p refs
(Contract N00014-75-C-0267; Grant NSF MCS-76-81259)
(AD-A060821; SU-TR-78-3) Avail: NTIS HC A02/MF A01 CSCL 12/1

This study combines least-index pivot selection rules with Keller's algorithm for quadratic programming to obtain a finite method for processing degenerate problems.
GRA

N79-15700# Army Armament Research and Development Command, Aberdeen Proving Ground, Md. Ballistics Research Lab.
THE DAVE SYSTEM: A CRITIQUE AND GUIDE FOR USE AT THE BALLISTIC RESEARCH LABORATORY
Morton A. Hirschberg, Joseph Lacetera, and William Buchheister Aug. 1978 34 p refs
(DA Proj. 1L1-61102-AH-43)
(AD-A060674; AD-E430107; ARBRL-MR-02858) Avail: NTIS HC A03/MF A01 CSCL 09/2

DAVE is a static program analyzer. That is, DAVE looks at ANSI standard FORTRAN programs of moderate size and provides documentation, analysis, validation and error detection (hence, its well hidden acronym), without executing the program. This paper endeavors to critique the DAVE system in an unbiased

fashion. The authors were without prior knowledge of the system before its purchase. It is the authors' conclusion however, that DAVE represents a useful validation tool for analysis of FORTRAN programs, beyond that initially provided by compiler.
Author (GRA)

N79-15701# Stanford Univ., Calif. Dept. of Computer Science.
SOFTWARE RESTYLING IN GRAPHICS AND PROGRAMMING LANGUAGES
Eric Grosse Sep. 1978 33 p refs
(Grant DAHC04-75-G-0185)
(AD-A060793; SU-STAN-CS-78-663) Avail: NTIS HC A03/MF A01 CSCL 09/2

The value of large software products can be cheaply increased by adding restyled interfaces that attract new users. As examples of this approach, a set of graphics primitives and a language precompiler for scientific computation are described. These two systems include a general user-defined coordinate, system instead of numerous system settings, indention to specify block structure, a modified indexing convention for array parameters, a syntax for n-and-a-half-times; -round loops, and engineering format for real constants; most of all, they strive to be as small as possible.
Author (GRA)

N79-15702# George Washington Univ., Washington, D. C. Program in Logistics.
OPTIMAL TIME INTERVALS FOR TESTING HYPOTHESIS ON COMPUTER SOFTWARE ERRORS
Ernest H. Forman and Nozer D. Singpurwalla 26 Jun. 1978 18 p refs
(Contract N00014-75-C-0729)
(AD-A060788; SERIAL-T-382) Avail: NTIS HC A02/MF A01 CSCL 09/2

In this paper certain stochastic aspects of the software reliability problem are discussed. First an empirical stopping note for debugging and testing computer software is discussed. Next are present some results on choosing a time interval for testing the hypothesis that a software system contains no errors, given certain cost and risk constraints.
Author (GRA)

N79-15703# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
ACQUISITION OF EMBEDDED COMPUTER SOFTWARE: A DESCRIPTIVE MODEL M.S. Thesis - Missouri Univ.-Rolla
Jerry Keith Watson 1977 78 p refs
(AD-A059799; CI-78-121T) Avail: NTIS HC A05/MF A01 CSCL 09/2

The process of acquiring Embedded Computer Systems (ECS) within the United States Air Force and the Department of Defense is investigated. The major objective is to provide a descriptive model of the Embedded Computer System acquisition process. It is recognized that methods, procedures, rules and regulations applying to ECS acquisition are dynamic in nature. This model therefore depicts the ECS acquisition process in its current state. This study is intended to be of assistance to those charged with managing acquisitions and developing solutions to the many problems of acquiring ECS. Definitions of terms and concepts which become troublesome in ECS procurements are provided and software is placed in proper perspective with hardware.
Author

62 COMPUTER SYSTEMS

Includes computer networks.

No abstracts in this category.

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support.*

N79-15704# Army Missile Research and Development Command, Redstone Arsenal, Ala.
INVESTIGATION OF DISTURBANCE ACCOMMODATING CONTROLLER DESIGN
Wayne L. McCowan 3 Jul. 1978 102 p refs
(AD-A060628; DRDMI-T-78-65) Avail: NTIS HC A06/MF A01 CSCL 09/3

This report presents the results of an application of Disturbance Accommodating Controller design techniques to three example control problems involving unmeasurable external disturbances of the waveform-mode type.
Author (GRA)

N79-15705# Naval Research Lab., Washington, D. C.
PATTERN RECOGNITION WITH PARTLY MISSING DATA
John K. Dixon Aug. 1978 20 p refs
(AD-A060736; AD-E000230; NRL-MR-3825) Avail: NTIS HC A02/MF A01 CSCL 09/4

This paper is an experimental comparison of several simple, cheap ways of doing pattern recognition when some data elements are missing (blank). Pattern recognition methods are usually designed to deal with perfect data, but in the real world data elements are often missing due to error, equipment failure, change of plans, etc. Six methods of dealing with blanks are tested on five data sets. Blanks were inserted at random locations into the data sets. A version of the K-nearest-neighbor technique was used to classify the data and evaluate the six methods. Two methods were found to be consistently poor. Four methods were found to be generally good. Suggestions are given for choosing the best method for a particular application.
Author (GRA)

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N79-15706# Stanford Univ., Calif. Dept. of Statistics.
TOWARD CHARACTERIZING BOOLEAN TRANSFORMATIONS
Alan E. Gelfand 23 Aug. 1978 21 p refs
(Contract N00014-76-C-0475; Grant DAAG29-77-G-0031)
(AD-A060916; SU-TR-261) Avail: NTIS HC A02/MF A01 CSCL 12/1

Binary switching nets have been presented as useful models for a variety of complex phenomena. Determinate binary functions describe the response of an element in such a net to its inputs. Such functions are called Boolean transformations. Three structural properties are studied of these transformations--forcibility, internal homogeneity and threshold.
GRA

N79-15707# Stanford Univ., Calif. Dept. of Statistics.
MAXIMUM LIKELIHOOD ESTIMATION FOR VECTOR AUTOREGRESSIVE MOVING AVERAGE MODELS
Theodore W. Anderson Jul. 1978 24 p refs
(Contract N00014-75-C-0442)
(AD-A060867; SU-TR-35) Avail: NTIS HC A02/MF A01 CSCL 12/1

The vector autoregressive moving average model is a multivariate stationary stochastic process where the unobservable multivariate process consists of independently identically distributed random vectors. The coefficient matrices and the covariance matrix are to be estimated from an observed sequence. Under the assumption of normality the method of maximum likelihood is applied to likelihoods suitably modified for techniques in the frequency and time domains. Newton-Raphson and scoring iterative methods are presented.
GRA

N79-15708# Stanford Univ., Calif. Dept. of Operations Research.

PROPERTIES OF CONJUGATE GRADIENT METHODS WITH INEXACT LINEAR SEARCHES

L. Nazareth and J. Nocedal Jan. 1978 18 p refs
(Contracts N00014-75-C-0865; EY-76-S-03-0326; Grants NSF MCS-76-20019; NSF ENG-77-06761; NR Proj. 047-143)
(AD-A060817; SU-SOL-78-1) Avail: NTIS HC A02/MF A01 CSCL 09/4

Conjugate gradient methods can be extended in a very natural way to take account of inexact linear searches. GRA

N79-15709# Florida State Univ., Tallahassee. Department of Statistics.

GENERALIZATION OF ASSOCIATED RANDOM VARIABLES WITH APPLICATIONS

Abdul-Hadi N. Ahmed, Ramon V. Leon, and Frank Proschan May 1978 32 p refs
(Grants AF-AFOSR-2581-74; PHS-ES-07011; AF Proj.
(AD-A058946; FSU-STATISTICS-M468; TR-82;
AFOSR-78-1244TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

The notion of association of random variables is generalized by considering increasing functions on certain partially ordered spaces. The resulting generalized association enjoys many of the basic properties processed by the original notion of association. An essential connection is obtained between the original notion of association and the generalized notion. A basic theorem is obtained showing that generalized association is inherited under certain commonly encountered mixing processes. Applications of this theory are made by considering particular types of ordering, such as absolute value ordering, unimodal ordering as well as the standard linear ordering of the real numbers. Author

N79-15710# George Washington Univ., Washington, D. C. Inst. for Management Sci. and Engineering.

NONLINEAR PROGRAMMING SENSITIVITY ANALYSIS RESULTS USING STRONG SECOND ORDER ASSUMPTIONS

Anthony V. Fiacco 26 Jun. 1978 41 p refs
(Grant DAAG29-76-G-0150)
(AD-A058633; T-377; ARO-13622.4-M) Avail: NTIS HC A03/MF A01 CSCL 12/1

A basis is developed for calculating the first partial derivatives of a Kuhn-Tucker triple and the first and second partial derivatives of the optimal value function, with respect to problem parameters. In the context of prior results, a simpler but much more general derivation of the Kuhn-Tucker triple derivatives is presented, and a more concise formula for the Hessian of the optimal value function is given. Particularizations to the problems with right hand side constraint perturbations, no constraint perturbations, and no constraints follow easily and are briefly treated. Further extensions and applications are indicated. G.G.

N79-15711# Naval Research Lab., Washington, D. C.

A MODIFIED SRIF FILTER USING LDL FACTORIZATIONS Interim Report

B. H. Cantrell May 1978 16 p ref
(RR0210517; RR0210541)
(AD-A060745; AD-E000217) Avail: NTIS HC A02/MF A01 CSCL 12/1

The square-root information filter (SRIF filter), which is a numerical method of implementing the Kalman filter, was investigated. The SRIF filter was modified to accommodate LDLI factorization of the covariance rather than the usual LL1 factorizations. This modification led to eliminating the square-root operations in the prewhiting process and a simple means of implementing a fading memory. Author (GRA)

N79-15712# Wisconsin Univ. - Madison. Mathematics Research Center.

A RECURSIVE APPROACH TO PARAMETER ESTIMATION IN REGRESSION AND TIME SERIES MODELS

Johannes Ledolter May 1978 18 p refs
(Contract DAAG29-75-C-0024; Grant NSF MCS-75-17385)
(AD-A060717; MRC-TSR-1853) Avail: NTIS HC A02/MF A01 CSCL 12/1

This paper discusses the recursive (on line) estimation of parameters in regression and autoregressive integrated moving average (ARIMA) time series models. The approach which is adopted uses Kalman filtering techniques to calculate estimates recursively. This approach can be used for the case of constant as well as time varying parameters. In the first section the linear regression model is considered and recursive estimates of the parameters, both for constant and time varying parameters, are discussed. Since the stochastic model for the parameters over time will be rarely known, simplifying assumptions have to be made. In particular, a random walk as a model for time varying parameters is assumed and it is shown how one can determine whether the parameters are constant or changing over time. In the second section the recursive estimation of parameters in ARIMA models is considered. If moving average terms are present, the model has to be linearized and the Extended Kalman Filter can be used to recursively update the parameter estimates. The first order moving average model is discussed in detail.

Author (GRA)

N79-15713# Wisconsin Univ. - Madison. Mathematics Research Center.

STABILITY OF INTERPOLATING ELASTICA

Michael Golomb May 1978 54 p refs
(Contract DAAG29-75-C-0024)
(AD-A060716; MRC-TSR-1852) Avail: NTIS HC A04/MF A01 CSCL 12/1

It is an old technique of draftsmen to use a mechanical spline to pass a smooth curve through a prescribed set of points in a plane. Curves which are obtained in this way (interpolating elastica, also called nonlinear spline curves) may be considered as the equilibrium positions of thin elastic beams which are constrained to pass through short, friction-less, freely rotating sleeve supports, anchored at the interpolation points. The strain energy of such a beam is given by the integral of the square of the curvature with respect to arc length, and equilibrium requires that the position be such that the energy be minimum for the given interpolation conditions. However, a global minimum cannot be attained (except in the trivial case of the unbent beam) since the energy can be made arbitrarily small by using sufficiently large loops between the supports. Instead one looks for local minima which guarantee stability against small perturbations. In this report some general stability criteria are established and some specific interpolating elastica are investigated for stability. Except for a few previous isolated observations these seem to be the first proven results on the stability of interpolating elastica. GRA

N79-15714# Wisconsin Univ. - Madison. Mathematics Research Center.

ON THE RELATIONSHIP OF SOME RESULTS OF GELFAND-DIKII AND P. MOERBEKE, AND A NATURAL TRACE FUNCTIONAL FOR FORMAL ASYMPTOTIC PSEUDO-DIFFERENTIAL OPERATORS

M. Adler Apr. 1978 39 p refs
(Contract DAAG29-75-C-0024; Grant NSF MCS-75-17385)
(AD-A060656; MRC-TSR-1841) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper developed out of an attempt to understand results of Gelfand-Dikii and P. Moerbeke in a unified way. A natural abstract setting is provided for understanding the symplectic structure involved in both results. The setting is an orbit in the dual algebra of a group. A natural trace functional for formal asymptotic pseudo-differential operators is discussed, as well as so-called Lenard recursion relations inherent in these structures. GRA

N79-15715# Wisconsin Univ. - Madison. Mathematics Research Center.

INVERSE BOUNDARY VALUE PROBLEMS AND A THEOREM OF GELFAND AND LEVITAN

W. Symes Apr. 1978 29 p refs
(Contract DAAG29-75-C-0024; Grant NSF MCS-75-17385)
(AD-A060659; MRC-TSR-1846) Avail: NTIS HC A03/MF A01 CSCL 12/1

Two so-called inverse problems of mathematical physics are considered. The problem of determining a second-order differential operator (in a normal form) on the half-axis from its spectral function, and the problem of determining a hyperbolic boundary value problem of a special form in a (non-characteristic) half-plane

from its response on the boundary to a unit impulse at some reference time t = 0 (boundary response on the boundary to a unit impulse at some reference time t = 0 (boundary value of the Riemann function). G.G.

N79-15716# Wisconsin Univ. - Madison. Mathematics Research Center.

SOLVING DIFFERENTIAL EQUATIONS ON A HAND HELD PROGRAMMABLE CALCULATOR

J. Barkley Rosser Apr. 1978 45 p refs

(Contract DAAG29-75-C-0024)

(AD-A060661; MRC-TSR-1848) Avail: NTIS HC A03/MF A01 CSCL 12/1

Most scientists who occasionally have to solve numerically a differential equation now own a hand held programmable calculator which will very often be adequate. Since hand held calculators are slow, there is particular need to keep the number of function evaluations to a minimum. At first thought, this would seem to rule out use of Runge-Kutta methods, but recent developments may make them competitive after all. In the area of predictor-corrector methods, some variations make excessive use of memory locations for a hand held calculator. An analysis of such matters is made in order to advise as to good procedures to follow, including alerting the solver to methods that are seldom taught in numerical analysis courses (where the emphasis is on the use of large fast computers). GRA

N79-15717# Wisconsin Univ. - Madison. Mathematics Research Center.

A COMBINATORIAL PROBLEM ARISING IN THE STUDY OF REACTION-DIFFUSION EQUATIONS

J. Greenberg, C. Greene, and S. Hastings May 1978 19 p refs

(Contract DAAG29-75-C-0024)

(AD-A060663; MRC-TSR-1850) Avail: NTIS HC A02/MF A01 CSCL 12/1

A discrete model is studied based on the observed behavior of excitable media. This model has the basic properties of an excitable medium, that is, a threshold phenomenon, a refractory period, and a globally stable rest point. We are mainly interested in two dimensional periodic patterns. The initial conditions which lead to such patterns are characterized by introducing a basic invariant, the 'winding number of a continuous cycle'. GRA

N79-15718# Wisconsin Univ. - Madison. Mathematics Research Center.

A GENERALIZATION OF ULTRASPHERICAL POLYNOMIALS

Richard Askey and Mourad E. H. Ismail May 1978 32 p refs

(Contract DAAG29-75-C-0024)

(AD-A060664; MRC-TSR-1851) Avail: NTIS HC A03/MF A01 CSCL 12/1

Some old polynomials of L. J. Rogers are orthogonal. Their weight function is given. The connection coefficient problem, which Rogers solved by guessing the formula and proving it by induction, is derived in a natural way and some other formulas are obtained. These polynomials generalize zonal spherical harmonics on spheres and include as special cases polynomials that are spherical functions on rank one spaces over reductive p-adic groups. A limiting case contains some Jacobi polynomials studied by Hylleraas that arose in work on the Yukawa potential. Author (GRA)

N79-15719# Wisconsin Univ. - Madison. Mathematics Research Center.

A THEORY FOR IMPERFECT BIFURCATION VIA SINGULARITY THEORY

M. A. Golubitsky and D. G. Schaeffer Apr. 1978 66 p refs

(Contract DAAG29-75-C-0024; Grants NSF MCS-77-03655; NSF MCS-77-04148)

(AD-A060619; MRC-TSR-1844) Avail: NTIS HC A04/MF A01 CSCL 12/1

This paper applies the theory of singularities of differentiable mappings - specifically the unfolding theorem - to study the effect of imperfections in a system subject to bifurcation. In a number of special cases we have classified (up to a suitable equivalence) all the possible perturbations of the bifurcation equations by a finite number of imperfection parameters. These cases include both bifurcation from a double eigenvalue and from a simple eigenvalue degenerate in the sense of Crandall-Rabinowitz. GRA

N79-15720# Wisconsin Univ. - Madison. Mathematics Research Center.

MIXED BOUNDARY VALUE PROBLEMS FOR THE ELASTIC STRIP: THE EIGENFUNCTION EXPANSION

D. A. Spence Jul. 1978 55 p refs

(Contract DAAG29-75-C-0024)

(AD-A060621; MRC-TSR-1863) Avail: NTIS HC A04/MF A01 CSCL 12/1

The stress function for a semi-infinite elastic strip with free edges is expanded in eigenfunctions of Papkovitch-Fad'le type, and biorthogonal functions are constructed by use of the adjoint operator. To establish completeness, the same expansion is obtained by a Fourier transform solution of the biharmonic equation. When end data is supplied in the form of prescribed tractions or prescribed displacements, the coefficients in the expansion must be found by truncation of an infinite set of linear equations. It is noted that the methods for formulating such equations that have been proposed in the past are unstable with respect to the order of truncation. GRA

N79-15721# Naval Research Lab., Washington, D. C.

DISCRETE FOURIER TRANSFORMS FOR SYMMETRIC OR ANTISYMMETRIC REAL SEQUENCES WITH THE POINT OF SYMMETRY OR ANTISYMMETRY MIDWAY BETWEEN TWO CELLS Interim Report

Bart Rice, Joseph H. Orens, Roswell Lee, and Jay P. Boris Jun. 1978 9 p ref

(RR0110941)

(AD-A060746; AD-E000220; NRL-MR-3640) Avail: NTIS HC A02/MF A01 CSCL 12/1

A technique is presented for performing the finite discrete Fourier transforms on real sequences which satisfy either symmetric or antisymmetric boundary conditions and which have the point of symmetry or antisymmetry at the midpoint between two cells. The method approximately halves the number of operations required if symmetry or antisymmetry is ignored.

Author (GRA)

N79-15722# Wisconsin Univ. - Madison. Mathematics Research Center.

COMPUTABLE ERROR BOUNDS FOR THE NYSTROEM METHOD

J. W. Hilgers (Michigan Technological Univ., Houghton) and L. B. Rall Jun. 1978 19 p refs

(Contract DAAG29-75-C-0024)

(AD-A060720; MRC-TSR-1858) Avail: NTIS HC A02/MF A01 CSCL 12/1

The classical Nystroem method for the numerical solution of Fredholm integral equations of second kind consists of numerical integration, collocation, and interpolation. The approximate solution obtained by this procedure is shown to be identical to the solution of certain finite-rank integral equations with kernels belonging to a specified class (K sub n), and thus has minimal error with respect to approximation of the original equation over this class. A computable (but in general nonoptimal) error bound for the Nystroem approximate solution can be obtained on the basis of how well a specific finite-rank integral operator with kernel in (K sub n) approximates the integral operator in the Fredholm equation being solved numerically. Author (GRA)

N79-15723# Oakland Univ., Rochester, Mich. Dept. of Chemistry.

THE EVALUATION OF MATRIX ELEMENTS WITH GENERALIZED SPHERICAL GAUSSIAN WAVEFUNCTIONS. PART 1: SINGLE PARTICLE, ONE- AND TWO-CENTER FORMS Progress Report, 1 May 1977 - 31 Apr. 1978

P. P. Schmidt Aug. 1978 19 p refs Submitted for publication

(Contract N00014-77-C-0293; NR Proj. 359-648)

(AD-A059533; TR-1) Avail: NTIS HC A02/MF A01 CSCL 12/1

General expressions are provided for the two-center matrix elements for the unity, kinetic, and electrostatic potential energy operators evaluated in terms of the elements of a general set

of Gaussian functions. The formulas derived are valid for all orders of n, l, and m. The single center forms follow automatically from the two-center forms in the vanishing separation limit.
Author

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N79-15724# Stanford Univ., Calif. Dept. of Statistics.
ON THE HALF-SAMPLE METHOD FOR GOODNESS-OF-FIT
Michael A. Stephens Jul. 1978 15 p refs
(Contract N00014-76-C-0475; Grant DAAG29-77-G-0031)
(AD-A060853; SU-TR-260; SU-TR-20) Avail: NTIS HC A02/MF A01 CSCL 12/1

Two interesting processes, related to the empirical distribution function, have been pointed out by Rao (1972) and by Durbin (1973). The second, in particular, leads to the half-sample method, an elegant and simple technique for dealing with unknown parameters in goodness-of-fit testing, without the necessity of new tables of percentage points for each distribution tested. To those who have spent some effort in producing such tables, it is natural to wonder whether this effort has been in vain. This paper shows that the answer is no. GRA

N79-15725# Stanford Univ., Calif. Dept. of Statistics.
CORRECTED DIFFUSION APPROXIMATIONS IN CERTAIN RANDOM WALK PROBLEMS
D. Siegmund Aug. 1978 32 p refs
(Contract N00014-77-C-0306; Grant NSF MCS-77-16964)
(AD-A060863; SU-TR-4; SU-TR-118) Avail: NTIS HC A03/MF A01 CSCL 12/1

Correction terms are obtained for the diffusion approximation to one and two barrier ruin problems in finite and infinite time. The corrections involve moments of ladder height distributions, and a method is given for calculating them numerically. Examples show that the corrected approximations can be much more accurate than the originals. Author (GRA)

N79-15726# Stanford Univ., Calif. Dept. of Statistics.
MAXIMUM LIKELIHOOD ESTIMATION OF THE COVARIANCES OF THE VECTOR MOVING AVERAGE MODELS IN THE TIME AND FREQUENCY DOMAINS
F. Ahrabi Aug. 1978 44 p refs
(Contract N00014-75-C-0422)
(AD-A060820; TR-36) Avail: NTIS HC A03/MF A01 CSCL 12/1

The vector moving average process is a stationary stochastic process, where the unobservable process consists of independently identically distributed random variables. The matrix parameters are estimated from the observations. The likelihood function is derived under normality and to solve the maximum likelihood equations the Newton-Raphson and Scoring methods are used. The estimation problem is considered in the time and frequency domains. Asymptotic efficiency of the estimates is established. GRA

N79-15727# Stanford Univ., Calif. Dept. of Statistics.
GOODNESS OF FIT TESTS WITH SPECIAL REFERENCE TO TESTS FOR EXPONENTIALITY
Michael A. Stephens Sep. 1978 32 p refs
(Contract N00014-76-C-0475; Grant DAAG29-77-G-0031)
(AD-A060824; SU-TR-262; SU-TR-22) Avail: NTIS HC A03/MF A01 CSCL 12/1

A general review is given of recent advances in goodness-of-fit, and some principles are stated which it is desirable that a goodness-of-fit test should follow. The second part of the paper deals with a list of proposed tests for the exponential distribution, and some of the ways in which they are interconnected are demonstrated. The power of the tests is examined by Monte Carlo studies and two tables are given. Author (GRA)

N79-15728# Washington Univ., Seattle. Dept. of Electrical Engineering.
INVERSES FOR DISCRETE-TIME STOCHASTIC LINEAR SYSTEMS Interim Report
James S. Meditch Mar. 1978 8 p refs Proc. of the 1978 Conf. on Inform. Sci. and Systems, Baltimore, 29-31 Mar. 1978 p 124-128
(Grant AF-AFOSR-3546-78; AF Proj. 2304)
(AD-A056750; AFOSR-78-1180TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

A theory of inverses for discrete-time stochastic linear systems is developed utilizing the methods of fixed-lag smoothing. The structure of these inverses is shown to be that of a multivariable finite impulse response digital filter whose input is the innovations process from the Kalman filter for the original system. As a result of this structure, L-delay stochastic inverses always exist and are stable for all finite L > or equal to l under the same conditions that provide existence and stability of the Kalman filter. GRA

N79-15729# Purdue Univ., Lafayette, Ind. Dept. of Statistics.
AN ESSENTIALLY COMPLETE CLASS OF MULTIPLE DECISION PROCEDURES
Shanti S. Gupta and Deng-Yuan Huang (Academia Sinica, Taipei, Taiwan) Jun. 1978 12 p refs
(Contract N00014-75-C-0455)
(AD-A056776; MMS-78-12) Avail: NTIS HC A02/MF A01 CSCL 12/1

Let pi sub 1, pi sub k represent k (greater than or equal to 2) independent populations. The quality of the ith population pi sub i is characterized by a real-valued parameter theta sub i, usually unknown. The best population is defined in terms of a measure of separation between theta sub i's. A selection of a subset containing the best population is called a correct selection (CS). Attention is restricted to rules for which the size of the selected subset is controlled at a given point and the infimum of the probability of correct selection over the parameter space is maximized. The main theorem deals with construction of an essentially complete class of selection rules of the above type. Some classical subset selection rules are shown to belong to this class. Author

N79-15730# Temple Univ., Philadelphia, Pa. Dept. of Mathematics.
STATISTICAL ASPECTS OF EXTREME VALUE THEORY Interim Report
Janos Galambos Jul. 1978 7 p refs
(Grant AF-AFOSR-3504-78; AF Proj. 1304)
(AD-A059022; AFOSR-78-1139TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Let X sub 1, X sub 2,...X sub n be random variables with common distribution function F(x). Put Z sub n = max(X sub 1, X sub 2,..., X sub n). Assume that the interdependence of the X sub j is such that, with suitable constants a sub n and b sub n greater than 0, P(Z sub n less than a sub n + b sub n x), is asymptotical F super n(a sub n + b sub n x) for models with this property. For most functions F(x) occuring in practice, (Z sub n - a sub n)/b sub n has an asymptotic distribution H(x) as n yield + infinity. This asymptotic distribution is necessarily one of three classical types. However, if F(x) is not known, then neither the normalizing constraints a sub n and b sub n' nor the actual type of the limit distribution H(x) can be determined. Since goodness of fit tests are not sensitive for the tail of the distribution F(x), and since an estimate for F(x) is not suitable in extreme value theory, some other techniques are needed which are free from F(x). In such a method, a number of upper extremes and the parametric form of the three classical types for H(x), known as the von Mises form, are used. G.G.

N79-15731# Temple Univ., Philadelphia, Pa. Department of Mathematics.
EXTREME VALUE THEORY IN APPLIED PROBABILITY Interim Report
Janos Galambos Jul. 1978 13 p refs Presented at Conf. on Stochastic Processes and their Appl., Canberra, Australia, 6-10 Jul. 1978
(Grant AF-AFOSR-3504-78; AF Proj. 2304)
(AD-A059021; AFOSR-78-1138TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Problems of applied probability are considered in terms of the extremes of a sequence of random variables. Several models are described with emphasis on the possibility of approximations by independent random variables. Rules for applying the asymptotic extreme value theory are given. J.M.S.

N79-15732# Purdue Univ., Lafayette, Ind. Dept. of Electrical Engineering.

A PATTERN DEFORMATIONAL MODEL AND BAYES ERROR-CORRECTING RECOGNITION SYSTEM Interim Report

W. H. Tsai and K. S. Fu 1978 9 p refs Presented at IEEE Intern. Conf. on Cybernetics and Soc., Tokyo, Japan, 3-5 Nov. 1978 p 1-6

(Grant AF-AFOSR-2661-74; MDA903-77-G-1)

(AD-A059115; AFOSR-78-1135TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Various types of pattern deformations are investigated from a syntactic point of view and categorized into two major types: local deformation and structural deformation. Random noise and substitutions of pattern primitives belong to the former; errors due to pattern structural changes belong to the latter. A local deformation is further decomposed into two steps: a syntactic deformation followed by a semantic one, the former being induced on the primitive structures and the latter on the primitive attributes (numerical properties). According to this deformational model, an error-correcting parsing scheme which is optimal in Bayes sense for local deformation is proposed. A corresponding recognition rule for pattern classification is described. Author

N79-15733# Cornell Univ., Ithaca, N. Y. School of Operations Research and Industrial Engineering.

MULTIPLE-DECISION SELECTION AND RANKING PROCEDURES Final Report, 1 Oct. 1976 - 15 Aug. 1978

Robert E. Bechhofer 20 Sep. 1978 12 p refs

(Contracts DAAG29-77-C-0003; DAAG29-73-C-0008; Grant DA-31-124-ARO(D)-474)

(AD-A060470; ARO-13858.9-M) Avail: NTIS HC A02/MF A01 CSCL 12/1

This is the final report on Contract DAAG-29-77-C-0003 entitled 'Multiple-Decision Selection and Ranking Procedures.' The report lists the technical reports and published papers (and those accepted for or submitted for publication) which were written with the full or partial support of the contract. Also included is a list of the scientific personnel supported by the contract, and the advanced degrees earned by them while supported by the contract. Some general comments are made concerning research progress and implementation of findings. Author (GRA)

N79-15734# Southern Methodist Univ., Dallas, Tex. Dept. of Operations Research and Engineering Management.

SQUEEZE METHODS FOR GENERATING GAMMA VARIATES

Bruce W. Schmeiser Aug. 1978 24 p refs Revised

(Contract N00014-77-C-0425)

(AD-A060388; OREM-78009) Avail: NTIS HC A02/MF A01 CSCL 12/1

Two algorithms are given for generating gamma distributed random variables. The algorithms, which are valid when the shape parameter is greater than one, use a uniform majorizing function for the body of the distribution and exponential majorizing functions for the tails. The algorithms are self-contained, requiring only U(0,1) variates. Comparisons are made to three competitive algorithms in terms of marginal generation times, initialization time, and memory requirements. Both algorithms are faster than existing methods, for all values of the shape parameters. Author (GRA)

N79-15735# California Univ., Davis. Dept. of Mathematics.

PSEUDO MAXIMUM LIKELIHOOD ESTIMATION: THEORY AND APPLICATIONS

Gail G. Hannon and Francisco J. Samaniego Aug. 1978 52 p refs

(Grant AF-AFOSR-3180-77)

(AD-A060387; TR-7; AFOSR-78-1416TR) Avail: NTIS HC A04/MF A01 CSCL 12/1

Pseudo maximum likelihood estimation easily extends to k parameter models, and is of interest in problems in which the likelihood surface is ill-behaved in higher dimensions but well-behaved in lower dimensions. Several signal plus noise or convolution models are examined which exhibit such behavior and satisfy the regularity conditions of the asymptotic theory. For specific models, a numerical comparison of asymptotic variances suggests that a psuedo maximum likelihood estimate of the signal parameter is uniformly more efficient than estimators that have been advanced by previous authors. A number of other potential applications are noted. GRA

N79-15736# Southern Methodist Univ., Dallas, Tex. Dept. of Operations Research and Engineering.

THE GENERATION OF ORDER STATISTICS IN DIGITAL COMPUTER SIMULATION: A SURVEY Final Report

Bruce W. Schmeiser Aug. 1978 10 p refs Submitted for publication

(Contract N00014-77-C-0425)

(AD-A060411; OREM-78011) Avail: NTIS HC A02/MF A01 CSCL 12/1

Order statistics are often needed in computer simulation. Common examples are quantile estimation and censored data test statistics. Methods for generating order statistics in various contexts are surveyed. Sorting and the use of histograms, the most general methods, are first discussed, followed by a method for non-identically distributed samples. Finally, the very powerful methods applicable to iid random variables are surveyed. Author (GRA)

N79-15737# Victoria Univ. (British Columbia). Dept. of Mathematics.

ALGORITHMS FOR LEAST-SQUARES LINEAR PREDICTION AND MAXIMUM ENTROPY SPECTRAL ANALYSIS

I. Barrodale and R. E. Erickson (Defence Research Establishment Pacific, Victoria, B.C.) Aug. 1978 53 p refs

(AD-A060420; DM-142-IR) Avail: NTIS HC A04/MF A01 CSCL 12/1

Experience with the maximum entropy method of spectral analysis suggests that it can produce inaccurate frequency estimates of short sample sinusoidal data, and it sometimes produces calculated values for the filter coefficients that are unduly contaminated by rounding errors. Consequently, this report develops an algorithm for solving the underlying least-squares problem directly, without forcing a Toeplitz structure on the model. This approach leads to more accurate frequency determination for short sample harmonic processes, and the algorithm is computationally efficient and numerically stable. The algorithm can also be applied to two other versions of the linear prediction problem. A FORTRAN program is supplied. GRA

N79-15738# Kentucky Univ., Lexington. Dept. of Mathematics.

ON THE STOCHASTIC REALIZATION PROBLEM, REVISION Interim Report

Anders Lindquist and Giorgio Picci (Lar. per Ricerche di Din. dei Sistemi e di Elettronica Biomed., CNR, Padova, Italy) 1978 37 p refs Revised

(Grants AF-AFOSR-3519-78; NSF MPS-75-07028)

(AD-A060418; AFOSR-78-1415TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

Given a mean-square continuous stochastic vector process y with stationary increments and a rational spectral density Phi such that Phi(infinity) is finite and nonsingular, consider the problem of finding all minimal Gauss-Markov representations (stochastic realizations) of y. All such realizations are characterized and classified with respect to deterministic as well as probabilistic properties. It is shown that only certain realizations (internal Stochastic realizations) can be determined from the given output process y. All others (external stochastic realizations) require that the probability space be extended with an exogeneous random component. A complete characterization of the sets of internal and external stochastic realizations is provided. It is shown that the state process of any internal stochastic realization can be expressed in terms of two steady-state Kalman-Bucy filters, one evolving forward in time over the infinite past and one backward over the infinite future. An algorithm is presented which generates families of external realizations defined on the same probability

space and totally ordered with respect to state covariances.
Author (GRA)

N79-15739# Wisconsin Univ. - Madison. Mathematics Research Center.
BAYESIAN INFERENCE ON PARAMETERS ASSOCIATED WITH FAMILIES CLOSED UNDER RECIPROCATION
Norman R. Draper and Irwin Guttman Mar. 1978 26 p refs
(Contract DAAG29-75-C-0024; Grant NSF MCS-76-83899)
(AD-A060855; MRC-TSR-1840) Avail: NTIS HC A03/MF A01 CSCL 12/1

Recently, Saunders 1974 has generalized the so-called reciprocal property for normality. Distributions having this property are called xi-normal, and it is of interest to make statistical inferences about the relevant parameters when sampling from such a distribution. Previous work on such problems has been from the sampling viewpoint. This paper approaches the inference problem from the Bayesian point of view and investigates the posterior of the parameters involved when sampling is from the xi-normal with parameters alpha and beta. Two spectral cases are examined. GRA

N79-15740# Wisconsin Univ. - Madison. Mathematics Research Center.
TESTING FOR PERIODICITY IN A TIME SERIES
Andrew F. Siegel Apr. 1978 19 p refs
(Contract DAAG29-75-C-0024; Grant DAAG29-77-G-0031)
(AD-A060657; MRC-TSR-1843) Avail: NTIS HC A02/MF A01 CSCL 12/1

In 1929, Sir R. A. Fisher proposed a test for periodicity in a time series based on the maximum spectrogram ordinate. This paper proposes a one-parameter family of tests that contains Fisher's test as a special case. It is shown how to select from this family a test that will have substantially larger power than Fisher's test against many alternatives, yet will lose only negligible power against alternatives for which Fisher's test is known to be optimal. Critical values are calculated and tabled using a duality with the problem of covering a circle with random arcs. The power is studied using Monte Carlo techniques. The method is applied to the study of the magnitude of a variable star, showing that these power gains can be realized in practice.GRA

N79-15741# Wisconsin Univ. - Madison. Mathematics Research Center.
A POISSON STRUCTURE ON SPACES OF SYMBOLS Summary Report
W. Symes Apr. 1978 51 p refs
(Contract DAAG29-75-C-0024; Grant NSF MCS-75-17385)
(AD-A060660; MRC-TSR-1847) Avail: NTIS HC A04/MF A01 CSCL 12/1

A Poisson structure (antisymmetric bilinear local operator on functionals, obeying the Jacobi identity) is established on certain function spaces (spaces of symbols of pseudodifferential operators on R to the nth power). The spaces of functionals thus become (infinite-dimensional) Lie Algebras. This type of Lie algebra structure has been established previously for functionals of functions of a single variable (n = 1) only. For n = 1, the theorem of Gardner, as generalized by Gelfand, Dikii, and others, is proved: that is, the residues of the zeta-function of the elliptic symbol are in involution with respect to the appropriate Poisson bracket. In contrast, it is shown by explicit example that the residues of the zeta functions of higher-dimensional elliptic symbols are generally not in involution. GRA

N79-15742# Florida State Univ., Tallahassee. Dept. of Statistics.
ON A CHARACTERIZATION OF MULTIVARIATE DISTRIBUTIONS WITH APPLICATIONS IN RELIABILITY AND EPIDEMIOLOGY Interim Report
Naftali A. Langberg Aug. 1978 19 p refs
(Grant AF-AFOSR-3109-76; AF Proj. 2304)
(AD-A060615; FSU-STATISTICS-M478; TR-12-AFOSR;
(Contracts DAAG29-77-C-0003; DAAG29-73-C-0008; Grant 12/1

Let T sub 1,...,T sub n be positive random variables with finite means. Further let I be the collection of all subsets of (1,...,n), and let xi be a function from the nth Euclidian space to I. It is proved that the minimum of (a sub i) (T sub i) over i from 1 to n and xi (a sub 1,...,a sub n) are independent random variables for every n real numbers a sub 1,...,a sub n if for every n positive real numbers b sub 1,...,b sub n and r = 1,...,n the random variables and T sub r/ET sub r are identically distributed. Further we provide an explicit formula for the distribution of xi(a sub 1,...,a sub n). Multivariate distributions that possess the independence property are presented. Their use in reliability growth or decay models as well as in Mathematical Epidemiology are discussed. GRA

N79-15743# Florida State Univ., Tallahassee. Dept. of Statistics.
CHARACTERIZATION OF NONPARAMETRIC CLASSES OF LIFE DISTRIBUTIONS Interim Report
Naftali A. Langberg, Ramon V. Leon, and Frank Proschan Jul. 1978 23 p refs
(Grant AF-AFOSR-3109-76; AF-AFOSR-2581-74; ES-07011)
(AD-A060417; FSU-STATISTICS-M473; AFOSR-78-1395TR; TR-86; AFOSR-N-TR-11) Avail: NTIS HC A02/MF A01 CSCL 12/1

This paper obtains characterizations of large classes of nonparametric life distributions, such as the increasing (decreasing) failure rate, increasing (decreasing) failure rate average, new better (worse) than used, etc., classes. The methods used differ from the usual functional equation methods used for the far more common characterizations of parametric families of life distributions. GRA

N79-15744# Syracuse Univ., N. Y. Dept. of Industrial Engineering and Operations Research.
OPTIMAL CONTROL OF RANDOM WALKS, BIRTHS AND DEATH PROCESSES AND QUEUES Interim Report
Richard F. Serfozo 1978 41 p refs
(Grant AF-AFOSR-2627-74; NSF ENG-75-13653; AF Proj. 2304)
(AD-A060682; AFOSR-78-1345TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

A random walk is considered on the nonnegative integers whose steps are controlled as follows. Upon arriving at a location i, a pair of probabilities (p,q) is selected from a given set, a reward r(i,p,q) is received, and the next step takes the walk to locations i+1, i-1 or i, with respective probabilities p, q and 1-p-q (q=0 when i=0). This is repeated indefinitely. A rule for successively selecting the probabilities (p,q) is a control policy. Conditions are identified on the rewards and probabilities under which there exist monotone optimal policies, for discounted and average rewards, and how to compute some of these policies is shown. For example, in certain settings it is optimal to increase the tendency of backward movement of the walk as its location increases. Similar results for controlling the parameters of a birth and death process and an M/M/1 queue is also shown.
Author (GRA)

N79-15745# North Carolina Univ. at Chapel Hill. Dept. of Biostatistics.
ON ALMOST SURE LINEARITY THEOREMS FOR SIGNED RANK ORDER STATISTICS Interim Report
P. K. Sen 1978 13 p refs
(Grant AF-AFOSR-2736-74; AF Proj. 2304)
(AD-A059420; AFOSR-78-1287TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Almost sure asymptotic linearity of signed rank order statistic in shift parameters is studied under suitable regularity conditions and the results are extended to stationary phi-mixing processes as well. Author

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N79-15746# Stanford Univ., Calif. Dept. of Operations Research.
COMPUTATION OF THE OPTIMAL AVERAGE COST POLICY FOR THE TWO TERMINAL SHUTTLE
Rajat K. Deb 30 Apr. 1978 35 p refs

(Contract N00014-76-C-0418; Grant NSF ENG-75-14847)
(AD-A060912; SU-TR-78) Avail: NTIS HC A03/MF A01 CSCL 15/5

The problem of determining the optimal average cost policy for operating a shuttle between two terminals is considered. The passengers arrive at each of the terminals according to Poisson processes and are transported by a single carrier with capacity Q smaller than or equal to infinity operating between the terminals. Under a fairly general cost structure, it is shown that the optimal average cost policy is monotone. Bounds are derived for the optimal control function and computational procedures for determining the optimal policy for both the finite and infinite capacity cases are presented. J.M.S.

N79-15747# California Univ., Berkeley.
DYNAMIC PRODUCTION FUNCTIONS
R. W. Shephard May 1978 22 p refs
(Contract N00014-76-C-0134; Grant NSF MCS-77-16054)
(AD-A059035; ORC-78-8) Avail: NTIS HC A02/MF A01 CSCL 12/2

An overview of a dynamic theory of production correspondences is developed because the process of production is decidedly evolutionary, and a steady state relationship between constant input and output rates fails to display the choices which can be made by shifting in time the allocation of variable input rates. An example of the construction of a dynamic activity analysis production correspondence is presented. S.E.S.

N79-15748# Massachusetts Inst. of Tech., Cambridge. Operations Research Center.
[OPERATIONS RESEARCH, INCLUDING NONDIFFERENTIABLE OPTIMIZATION AND MODELS OF URBAN AND ECONOMIC CONDITIONS] Annual Report, 1 Jul. 1977 - 30 Jun. 1978
30 Jun. 1978 56 p refs
(AD-A060520) Avail: NTIS HC A04/MF A01 CSCL 12/2

The Operations Research Center conducts interdepartmental academic and research programs in the field of operations research. One focus of basic research has been on nondifferentiable optimization. This has been motivated in large part from the Center's work on econometric models containing linear programming subproblems. Linear programs produce nondifferentiable parametric functions because of the abrupt changes in shadow prices as various optimal extreme point solutions are generated. Specifically, normative models for depletable resources with applications to energy planning have been developed and analyzed. Nondifferentiable optimization techniques are required, for example, to estimate derived demand curves for a scarce resource from a dynamic economic sectoral model. Another example is the use of nondifferentiable optimization to compute peak load electricity prices by perturbing peak load demand and reliability constraints in utility capacity expansion models. GRA

N79-15749# Decision-Science Applications, Inc., Arlington, Va.
VALUE-DRIVEN DECISION THEORY: APPLICATION TO COMBAT SIMULATIONS Final Report
G. L. Lucas, G. F. Gorman, and G. E. Pugh Jul. 1978 218 p refs
(Contract F49620-77-C-0089)
(AD-A060402; DSA-67) Avail: NTIS HC A10/MF A01 CSCL 12/2

This report describes the application of value-driven decision theory to the modeling of command, control, and communications, (C3) in computerized combat simulations. Value-driven decision theory provides an unusually powerful method for representing C3 in combat simulations, in that the theory provides an explicit representation of the human decision processes that drive the simulation. Each decision element represented in a value-drive simulation has its own internal model of the world which is formed by the integration of perceptions received via sensor and command links into a predefined structural model of the relevant portions of the external world. Employing its internal model, each decision element has the capability for generating and projecting alternative courses of action, for associating values or measures of worth with each alternative, and for selecting a language, preferences can be conveyed among the decision elements of a command hierarchy or among different decision levels of a given decision element. This capability provides the decision elements the flexibility to override command from higher level elements should circumstances strongly favor the adoption of an alternative course of action. GRA

N79-15750# Wisconsin Univ. - Madison. Mathematics Research Center.
ON SOLUTIONS OF NON-COOPERATIVE GAMES: AN AXIOMATIC APPROACH
Prakash P. Shenoy May 1978 19 p refs
(Contracts DAAG29-75-C-0024; Grant NSF MCS-75-17385)
(AD-A060662; MRC-TSR-1849) Avail: NTIS HC A02/MF A01 CSCL 12/1

This paper studies solutions of strict non-cooperative games that are played just once. The players are not allowed to communicate with each other. The main ingredient of our theory is the concept of rationalizing a set of strategies for each player of a game. An axiom based on this concept is stated that every solution of a non-cooperative game is required to satisfy. Strong Nash solvability is shown to be a sufficient condition for the rationalizing set to exist, but it is not necessary. Also, Nash solvability is neither necessary nor sufficient for the existence of the rationalizing set of a game. For a game with no solution (in our sense), a player is assumed to resort to a standard of behavior. Some standards of behavior are examined and discussed. GRA

N79-15751# Brown Univ., Providence, R. I.
MINIMUM EXIT PROBABILITIES AND DIFFERENTIAL GAMES Interim Report
W. H. Fleming and Chun-Ping Tsai (Kansas Univ., Lawrence) Jul. 1978 15 p refs
(Grants AF-AFOSR-3063-76; NSF MCS-76-07247; AF Proj. 2304)
(AD-A059419; AFOSR-78-1361TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

The problem considered is that of minimizing the probability that a controlled diffusion process exits from a given region of 'acceptable' states during a given time interval. The controlled diffusion obeys a stochastic differential equation driven by low intensity white noise. An asymptotic estimate of Ventcel-Freidlin type is given for the minimum exit probability. The crucial parameter in this estimate is the lower value of a certain differential game. Author

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N79-15752# Wisconsin Univ. - Madison. Mathematics Research Center.
REMARKS ON NONLINEAR ERGODIC THEORY IN HILBERT SPACE
A. Pazy Jul. 1978 18 p refs
(Contract DAAG29-75-C-0024; Grant NSF MCS-78-01245)
(AD-A060623; MRC-TSR-1866) Avail: NTIS HC A02/MF A01 CSCL 12/1

This note gives a simple unified presentation of some recent ergodic results for semigroups of nonexpansive mappings in Hilbert space. GRA

N79-15753# Wisconsin Univ. - Madison. Mathematics Research Center.
STRONG CONVERGENCE OF CONTRACTION SEMIGROUPS AND OF ITERATIVE METHODS FOR ACCRETIVE OPERATORS IN BANACH SPACES
Olavi Nevanlinna and Simeon Reich Jun. 1978 24 p refs
(Contract DAAG29-75-C-0024; Grant NSF MCS-75-17385)
(AD-A060718; MRC-TSR-1856) Avail: NTIS HC A02/MF A01 CSCL 12/1

This paper deals with two different but related topics: the behavior of evolution systems for large time, and finding zeros for certain operators. Pazy developed tools to analyze the behavior of some evolution systems. Here these tools can be used in a more general setting and therefore the results can be applied to a larger set of problems. Apply the same tools then to problems where time has been discretized. This gives iterative schemes for finding zeros for a large class of operators appearing both in

physics and in convex programming. In particular detailed information is obtained on the rates of these iteration schemes. GRA

N79-15754# Wisconsin Univ. - Madison. Mathematics Research Center.
GLOBAL ITERATION SCHEMES FOR MONOTONE OPERATORS
Olavi Nevanlinna Jul. 1978 20 p refs
(Contract DAAG29-75-C-0024; Grant NSF MCS-75-17385)
(AD-A060724; MRC-TSR-1862) Avail: NTIS HC A02/MF A01 CSCL 12/1

Given three globally convergent iteration schemes for finding zeros of maximal monotone operators in Hilbert spaces, assume that the operators are defined in the whole space and are either continuous, grow at most linearly at infinity or map bounded sets into bounded sets. Globally convergent iteration schemes for minimizing convex functionals in Hilbert spaces are given as applications. GRA

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N79-15755# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PRODUCTION OF ULTRAHIGH MAGNETIC FIELDS
H. Latal Dec. 1977 18 p refs Transl. into ENGLISH from Acta Phys. Austr. (Austria), v. 27, 1968 p 77-85 Presented at the Autumn Conf. of the Austr. Phys. Soc., Innsbruck, 1967
(AD-A058402; FTD-ID(RS)T-1876-77) Avail: NTIS HC A02/MF A01 CSCL 20/3

The principle of flux compression is examined and an implosion method is described for obtaining short-term magnetic fields of several megagauss (MG). A conducting cylindrical metal tube, the so-called liner, was radially compressed by a high explosive following which an initial field on the order of 50 kG was produced in the cavity using a Helmholtz coil. The highest field strengths attained with this method are around 15 MG and a Russian group gives 25 MG. Although electromagnetic compression does not lead to such high fields as the explosive method, it does provide ultrahigh magnetic fields which are sufficient for solid state physics, plasma physics, and quantum electrodynamics. Author

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N79-15756*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MODAL PROPAGATION ANGLES IN A CYLINDRICAL DUCT WITH FLOW AND THEIR RELATION TO SOUND RADIATION
Edward J. Rice, Marcus F. Heidmann, and Thomas G. Sofrin (Pratt and Whitney Aircraft, East Hartford, Conn.) Jan. 1979 12 p refs Presented at 17th Aerospace Sci. Meeting, New Orleans, La., 15-17 Jan. 1979; sponsored by AIAA
(NASA-TM-79030; E-9826) Avail: NTIS HC A02/MF A01 CSCL 20A

The main emphasis is upon the propagation angle with respect to the duct axis and its relation to the far-field acoustic radiation pattern. When the steady flow Mach number is accounted for in the duct, the propagation angle in the duct is shown to be coincident with the angle of the principal lobe of far-field radiation obtained using the Wiener-Hopf technique. Different Mach numbers are allowed within the duct and in the external field. For static tests with a steady flow in an inlet but with no external Mach number the far-field radiation pattern is shifted considerably toward the inlet axis when compared to zero Mach number radiation theory. As the external Mach number is increased the noise radiation pattern is shifted away from the inlet axis. The theory is developed using approximations for sound propagation in circular ducts. An exact analysis using Hankel function solutions for the zero Mach number case is given to provide a check of the simpler approximate theory. Author

N79-15757*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FEASIBILITY OF WING SHIELDING OF THE AIRPLANE INTERIOR FROM THE SHOCK NOISE GENERATED BY SUPERSONIC TIP SPEED PROPELLERS
James H. Dittmar Dec. 1978 25 p refs
(NASA-TM-79042; E-9845) Avail: NTIS HC A02/MF A01 CSCL 20A

A high tip speed turboprop is being considered as a future energy conservative airplane. The high tip speed of the propeller, combined with the speed of the airplane, results in supersonic relative flow on the propeller tips. These supersonic blade sections could generate noise that is a cabin environment problem. The feasibility of using wing shielding to lessen the impact of this supersonic propeller noise was investigated. An analytical model is chosen which considers that shock waves are associated with the propeller tip flow and indicates how they would be prevented from impinging on the airplane fuselage. An example calculation is performed where a swept wing is used to shield the fuselage from significant portions of the propeller shock waves. A.R.H.

N79-15758*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TONE NOISE OF THREE SUPERSONIC HELICAL TIP SPEED PROPELLERS IN A WIND TUNNEL AT 0.8 MACH NUMBER
James H. Dittmar, Bernard J. Blaha, and Robert J. Jeracki Dec. 1978 22 p refs
(NASA-TM-79046; E-9854) Avail: NTIS HC A02/MF A01 CSCL 20A

Three supersonic helical tip speed propellers were tested in the NASA Lewis 8- by 6-foot wind tunnel. Noise data were obtained while these propellers were operating at a simulated cruise condition. The walls of this tunnel were not acoustically treated and therefore this was not an ideal location for taking noise data, but it was thought that the differences in noise among the three propellers would be meaningful. The straight bladed propeller which did not incorporate sweep was the noisiest with the aerodynamically swept propeller only slightly quieter. However, the acoustically swept propeller was significantly quieter than the straight propeller, thereby indicating the merit of this design technique. Author

N79-15759*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OPTIMIZED MULTISECTIONED ACOUSTIC LINERS
Kenneth J. Baumeister 1979 17 p refs Presented at the 17th Aerospace Sci. Meeting, New Orleans, 15-17 Jan. 1979; sponsored by AIAA
(NASA-TM-79028; E-9823) Avail: NTIS HC A02/MF A01 CSCL 20A

New calculations show that segmenting is most efficient at high frequencies with relatively long duct lengths where the attenuation is low for both uniform and segmented liners. Statistical considerations indicate little advantage in using optimized liners with more than two segments while the bandwidth of an optimized two-segment liner is shown to be nearly equal to that of a uniform liner. Multielement liner calculations show a large degradation in performance due to changes in assumed input modal structure. Computer programs are used to generate theoretical attenuations for a number of liner configurations for liners in a rectangular duct with no mean flow. Overall, the use of optimized multisectioned liners fails to offer sufficient advantage over a uniform liner to warrant their use except in low frequency single mode application. Author

N79-15760*# New York Univ., N. Y. Dept. of Applied Science.
SONIC BOOM RESEARCH Final Report
Lu Ting Dec. 1978 27 p refs
(Grant NGL-33-016-119)

(NASA-CR-157964; NYU/DAS-78-26) Avail: NTIS HC A03/MF A01 CSCL 20A

It is demonstrated that a supersonic airplane configuration weighing over half a million pounds while creating a maximum sonic boom of less than 1 p.s.f. can be designed. New experimental techniques are developed in the wind tunnel and experiments for the sonic boom measurements were carried out. Theoretical analyses were performed for the effects of sonic boom on structures and pollution problems associated with supersonic flights were investigated. Numerical programs were generated for the sonic boom propagations from the near field of an airplane in supersonic flight at high altitude to the ground, taking into account the nonlinear effects and the asymmetric effects due to lift and the spacewise distributions of lift and volume. Author

N79-15761# Royal Aircraft Establishment, Farnborough (England).

THE IDENTIFICATION OF A SOURCE OF NOISE AND THE MEASUREMENT OF ITS EFFECT BY A CORRELATION METHOD

D. Audoynaud, A. Hellion, and B. Escudie Jul. 1978 36 p refs Transl. into ENGLISH from Rev. d'Acoustique (France), no 34, 1975 p 8-20

(RAE-Lib-Trans-1970; BR66044) Avail: NTIS HC A03/MF A01

The problem of identifying the position and characteristics of distant noise sources by methods based on signal analysis is considered. The properties of random functions and correlation functions are analyzed and correlation techniques are applied to the location of both narrowband and broadband sources. An experimental noise-location device used for investigating the noise emitted from an oil refinery is described which consists of a two-microphone 'telescope' and correlator. Results with narrowband and wideband sources are presented. It is concluded that: (1) a direction finding device operating on a correlation principle is feasible and can be made portable; (2) out of doors, atmospheric propagation effects limit the precision and reliability of measurement taken more than a few tens of metres from the source; and (3) angular resolution may be insufficient to separate multiple sources of sound on industrial sites. A.R.H.

N79-15762# Naval Research Lab., Washington, D. C.

EVALUATION OF THE RELATIVE IMPORTANCE OF CIRCUMFERENTIAL OR CREEPING WAVES IN THE ACOUSTIC SCATTERING FROM RIGID AND ELASTIC SOLID CYLINDERS AND FROM CYLINDRICAL SHELLS Interim Report

Louis R. Dragonette 22 Sep. 1978 68 p refs

(NRL Proj. S01-84; Proj. SF11-121)

(AD-A060836; NRL-8216) Avail: NTIS HC A04/MF A01 CSCL 20/1

The relationship is determined between predicted circumferential waves on cylinders and the normal-mode series solution for the acoustic scattering by submerged metal cylinders. Specific circumferential waves are linked to the free modes of vibration of the cylinder, and this identification is used to experimentally detect the Rayleigh surface wave at low ka. Circumferential waves on thin cylindrical shells are demonstrated to closely follow prediction based on Lamb theory for flat plates. Author (GRA)

N79-15763# Naval Ocean Systems Center, San Diego, Calif.

ANNOYANCE OF HELICOPTER BLADESLAP Research Report, May 1977 - Feb. 1978

R. G. Klumpp and D. R. Schmidt Jul. 1978 37 p refs

(YF57572001)

(AD-A060755; NOSC/TR-247) Avail: NTIS HC A03/MF A01 CSCL 01/3

To determine the possible underassessment of annoyance by A-weighted measurements, 28 subjects rated the annoyance of helicopter sounds by a magnitude estimation method. The sounds were recorded in a residential community and included samples ranging from no bladeslap to heavy bladeslap. The degree of underassessment of annoyance by an average A-weighted measure was found to be 2 db. This underassessment was found over the level range of 60 to 85 db(A) for two different listener groups, for bladeslap classification by listeners or by crest factor measurement, and for simulated inside listening. Author (GRA)

N79-15764# Illinois Univ. at Urbana-Champaign, Urbana. Coordinated Science Lab.

SURFACE ACOUSTIC WAVE TRANSDUCER STUDY Final Report, 28 May 1975 - 30 Sep. 1977

B. J. Hunsinger May 1978 162 p refs

(Contract F33615-75-C-1291)

(AD-A060395; AFAL-TR-78-60) Avail: NTIS HC A08/MF A01 CSCL 17/1

A theoretical and experimental study of surface acoustic wave transducers is carried out to improve the modeling technique and the implementation configuration. The capacity weighted transducer with the response controlled by integrated circuit capacitors has been developed. The response is improved because the SAW beam has a uniform width and the transducer taps may be adjusted over a wide range. The excitation theory of transducers has been reformulated to account for nearest neighbor interactions over a wide range of harmonics. This modeling approach significantly expands the versatility and accuracy of the model. An experimental procedure for measuring the transducer excitation function is described. Author (GRA)

N79-15765# Forest Products Lab., Madison, Wis.

SOUND INSULATION EVALUATION OF HIGH-PERFORMANCE WOOD-FRAME PARTY PARTITIONS UNDER LABORATORY AND FIELD CONDITIONS

Robert E. Jones 1978 41 p refs

(AD-A060654; FSRP-FPL-309) Avail: NTIS HC A03/MF A01 CSCL 11/12

Several building codes require airborne and impact sound insulation of Sound Transmission Class (STC) and Impact Insulation Class (IIC) greater than or equal to 50, 5 points higher than minimum property standards. This report describes lab and field data for wood-frame party walls and floors well in excess of the higher requirements. To explain and justify the high transmission loss (TL) performance, a combination of recent improvements in approximate TL theory and lab-field technologies is used. This combination proves a powerful tool in providing new insights into previous and current data. An abbreviated summary of these technologies is provided in the appendix.GRA

N79-15766# Naval Research Lab., Washington, D. C. Applied Ocean Acoustics.

TRANSVERSE COHERENCE OF LOW-FREQUENCY ACOUSTIC SIGNALS Interim Report

R. M. Fitzgerald, A. N. Gutherie, and J. D. Shaffer Aug. 1978 8 p refs

(XF52552700)

(AD-A060681; NRL-8241) Avail: NTIS HC A02/MF A01 CSCL 20/1

Results are reported for a long-range deep-ocean experiment in which a 15 hz cw source was towed transverse to the line of propagation to a single receiver. Reciprocity between transmitter and receiver roles is used to interpret the aperture formed by the moving source as a large receiving aperture. For the shallow source and bottom-suspended sofar-axial receiver employed, the largest physical broadside apertures yet reported over which the received signal was coherent was observed. The maximum observed coherent interval corresponds to a broadside aperture of 14 km at 1600 km range. The measured array gain for this aperture was 1.2 db less than the maximum possible.

Author (GRA)

N79-15767# Naval Research Lab., Washington, D. C. Acoustics Div.

ON THE RELATIONSHIP BETWEEN ARRAY PERFORMANCE AND THE EXISTENCE OF DETERMINISTIC FEATURES IN TRANSMISSION LOSS MEASUREMENTS Interim Report

D. R. Palmer Aug. 1978 21 p refs

(XF52552700)

(AD-A060712; AD-E000216; NRL-MR-3833) Avail: NTIS HC A02/MF A01 CSCL 20/1

A multi-component model of the acoustic signal is used to discuss the relationship between a well-defined convergence-zone structure in transmission-loss measurements and array performance. This particular model predicts that the presence of a convergence-zone structure indicates the random fluctuations in

the ocean are not strong enough to significantly degrade array performance. Author (GRA)

N79-15768# Naval Research Lab., Washington, D. C. Acoustics Div.
AN INTRODUCTION TO THE APPLICATION OF FEYNMAN PATH INTEGRALS TO SOUND PROPAGATION IN THE OCEAN Interim Report
David R. Palmer 6 Jan. 1978 94 p refs
(NRL Proj. S01-64.210; XF52552700)
(AD-A060734; AD-E000209; NRL-8148) Avail: NTIS HC A05/MF A01 CSCL 20/1

We review and unify those applications and techniques associated with Feynman's theory of path integrals which have been found relevant for sound propagation in the ocean. After giving an introductory discussion of functional integrals in general and Feynman path integrals in particular, we derive several path integral representations for the solutions to the two- and three-dimensional parabolic equations. The analogies which exist between sound propagation, the nonrelativistic quantum mechanics of a point particle, and Brownian motion are considered. Next we use the path integral to derive several methods of approximation including perturbation theory, the Rytov approximation, ray acoustics, and straight-line geometric optics. The formalism is then applied to the problem of developing algorithms for numerically solving the parabolic equation. After developing path integral representations for the solution to the Helmholtz equation, we give an extensive discussion of the parabolic approximation. Author (GRA)

N79-15769# Southwest Research Inst., San Antonio, Tex.
PROGRAM FOR FIELD VALIDATION OF THE SYNTHETIC APERTURE FOCUSING TECHNIQUE FOR ULTRASONIC TESTING (SAFT UT); ANALYSIS BEFORE TEST
J. L. Jackson Jul. 1978 50 p
(Contract NRC-04-77-145)
(PB-286857/8; NUREG-CR-0288) Avail: NTIS HC A03/MF A01 CSCL 14B

The purpose of the project is to validate the usefulness of SAFT UT for industrial nondestructive evaluations (NDE). SAFT UT is an ultrasonic imaging method for accurate measurement of the spatial location and extent of acoustically reflective surfaces (flaws) contained in objects such as structural components and weldments in nuclear power reactor systems. The increased measurement accuracy offered by SAFT, when compared with that provided by measurement methods now in use, will improve the reliability of flaw severity assessments with resultant safety and economic benefits to the nuclear power industry. To accomplish the objective, SwRI is to design and construct an imaging system, suitable for field use, using the SAFT UT and to conduct sufficient tests with the system to fully characterize its performance and usefulness for the intended purpose. The ultimate goal is to produce a field-rated system for highly accurate flaw size measurements and to conduct sufficient testing of that system to promote its acceptance by industrial and regulatory authorities. GRA

N79-15770# Southwest Research Inst., San Antonio, Tex.
PROGRAM FOR FIELD VALIDATION OF THE SYNTHETIC APERTURE FOCUSING TECHNIQUE FOR ULTRASONIC TESTING (SAFT UT)
J. L. Jackson Jul. 1978 52 p
(Contract NRC-04-77-145)
(PB-287317/2; NUREG-CR-0290) Avail: NTIS HC A04/MF A01 CSCL 14B

Efforts to determine the usefulness of the synthetic aperture focusing technique in ultrasonic tests are described. An ultrasonic imaging system for accurately measuring the spatial location and extent of acoustically reflective flaws contained in such objects as structural components and weldments in nuclear power reactor systems is proposed for field use so that its performance may be characterized. Sufficient tests are planned to promote its acceptance by industrial and regulatory agencies. GRA

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N79-15771# Naval Research Lab., Washington, D. C.
COLLISIONAL EMITTANCE GROWTH IN THE PARTICLE SIMULATION OF FOCUSED BEAM TRANSPORT Interim Report
I. Haber Jul. 1978 10 p refs
(AD-A060739; AD-E000225; NRL-MR-3817) Avail: NTIS HC A02/MF A01 CSCL 20/8

By varying the number of particles used in the simulation, it is shown that numerical collisions result in a non-physical emittance growth which is proportional to the collision frequency. It is also shown that enough particles can be used so that the systems behavior is independent of their number. Author (GRA)

N79-15772# Florida Univ., Gainesville.
HIGH SPIN MOLECULES: ESR OF MnF AND MnF2 AT 4K
T. C. DeVore, R. J. VanZee, and W. Weltner, Jr. Nov. 1977 8 p refs
(Grant AF-AFOSR-2906-76)
(AD-A059216; AFOSR-78-1321TR) Avail: NTIS HC A02/MF A01 CSCL 07/4

The magnetic parameters of MnF in solid neon were obtained and indicate that MnF is highly ionic with the spin density of each F probably less than 5%. The Mn(+) ion exhibits about 60% of the sigma characteristics of the free ion. MnF2 is linear with a 6 sigma g ground state. The magnetic parameters of both MnF and MnF2 are compared with those obtained from crystalline MnF2 and similar magnetic crystals. Author

N79-15773# Yale Univ., New Haven, Conn. Dept of Physics.
DOPPLER-FREE, LINEAR, SINGLE-PHOTON SPECTROSCOPY OF METASTABLE ATOMS AND MOLECULES
T. Wik, W. R. Bennett, Jr., and W. Lichten Dec. 1977 5 p refs Repr. from Phys. Review Letters, v. 40, no 16 - 17 Apr. 1978 p. 1080-1084
(Contract F44620-76-C-0078)
(AD-A059252; AFOSR-78-1329TR) Avail: NTIS HC A02/MF A01 CSCL 20/8

A tightly collimated beam of metastable atoms and molecules was crossed with a tunable-dye-laser beam. Absorption of light quenched the metastables beam. The method was used to resolve and measure the optical fine structure of the hydrogen molecule. Isotope shifts were measured in atomic neon. The possibility of increasing the precision in the measurement of the Rydberg constant is discussed. Author

N79-15774# Nevada Univ., Reno. Dept. of Chemistry.
MOLECULAR ENERGY TRANSFER STUDIES Final Report, 1 Oct. 1976 - 31 Jul. 1978
Hyung Kyu Shin 31 Jul. 1978 8 p refs
(Grant AF-AFOSR-3163-77; AF Proj. 2303)
(AD-A060616; AFOSR-78-1391TR) Avail: NTIS HC A02/MF A01 CSCL 20/8

The major objective of this project was to develop theoretical models and techniques for describing vibrational relaxation in molecular collisions at low temperatures. If attractive forces are sufficiently strong, the colliding molecules can form weakly bound complexes. Models have been developed to provide both a quantitative and a qualitative interpretation of the mechanisms and dynamics of intercomplex energy transfer processes. A.R.H.

N79-15775# Naval Research Lab., Washington, D. C.
TEMPORAL DEUTERON CURRENT DETERMINATIONS USING NEUTRON TIME-OF-FLIGHT
Frank C. Young, Stavros J. Stephanakis, S. Goldstein (Science Applications, McLean, Va.), D. Hinshelwood (JAYCOR, Alexandria, Va.), and D. Mosher Aug. 1978 26 p refs Presented at the 1978 IEEE Intern. Conf. on Plasma Sci., Monterey, Calif., May 1978
(AD-A060735; AD-E000229; NRL-MR-3823) Avail: NTIS HC A03/MF A01 CSCL 20/8

In experiments conducted on the NRL Gamble II device,

focused-ion currents have previously been inferred by combining time-integrated neutron yield data with time-resolved diode electrical characteristics in a model for ion production. The time variation of ion current can be determined in a more direct fashion from neutron time-of-flight measurements at various angles to the beam direction. Such measurements have recently been successfully carried out in the hard X-ray environment of Gamble II by employing fast-recovery scintillator-photomultiplier detectors. Measurements of the deuteron energy and emission time deduced from neutron time-of-flight are consistent with current understanding of the ion generation process. The ion current vs. time is unfolded from measured neutron signals by combining them with the temporally-resolved diode voltage and neutron-production cross sections. Author (GRA)

N79-15776# California Univ., Los Angeles. Dept. of Chemistry.
THE STUDY OF THE INTRAMOLECULAR HEAVY ATOM EFFECT IN 9, 10-DICHLOROPHENANTHRENE AND 1,2,3,4-TETRACHLORONAPHTHALENE USING PMDR TECHNIQUES Interim Technical Report
Talal Akasheh (Yarmouk Univ., Irbid, Jordan) 30 Jun. 1978 17 p refs Prepared for publication
(Contract N00014-75-C-0602; NR Proj. 056-498)
(AD-A056713; TR-30) Avail: NTIS HC A02/MF A01 CSCL 20/10

The heavy atom effect in triplet 9,10-dichlorophenanthrene and 1,2,3,4-tetrachloronaphthalene is investigated by PMDR techniques. As in the parent hydrocarbons, spin-orbit and spin-orbit vibronic mechanisms are invoked to explain the results. The relative radiative rates of the triplet zero-field levels are determined by static distortions of the chlorine atoms, while the intersystem crossing rates from S1 are mainly governed by the enhancement of spin-orbit vibronic coupling via C-Cl out-of-plane modes that mix the relevant delta, pi resonance and pi, pi resonance states. In both processes the top two levels (tau sub A and tau sub B) are more active, with tau sub B the most favored of the two. Author

N79-15777# Addis Translations International, Portola Valley, Calif.
ION-OPTICAL CHARACTERISTICS OF NEGATIVE H(-) ION BEAMS
G. E. Derevyankin, V. G. Dudnikov, and V. S. Klenov Aug. 1977 7 p refs Transl. into ENGLISH from Nuclear Phys. Inst. USSR Acad. of Sci. Preprint IYAF-77-8 (Novosibirsk), 1977 6 p Prepared for California Univ. Livermore Lawrence Livermore Lab.
(UCRL-Trans-11269; IYAF-77-8) Avail: NTIS HC A02/MF A01

The ion-optical characteristics of H(-) ion beams generated by surfaceplasma sources with a Penning configuration of the gas discharge cell were studied. H(-) ion beams with a pulse intensity of 0.1-0.15 A, duration of 250 micron seconds and repetition rate up to 100 Hz were obtained. The ion energy was 20-25 keV. The emission slit, 0.5.10 sq mm, was oriented across the magnetic field. Quasi-parellel beams with an ordered divergence of 0.01 radn per cm of transverse dimension were formed. When the fluctuations were eliminated, the normalized emittance in the direction parellel to the field decreased from 0.05 cm m rad n to 0.003 cm m rad n, in the perpendicular direction from 0.2 cm m rad n to 0.02 cm m rad n, and the energy scatter of transverse motion, from 1.5 keV to 5 eV and 80 eV to 1 eV, respectively. DOE

N79-15778# Georgia Inst. of Tech., Atlanta.
FORMATION OF EXCITED H BY IMPACT OF H1 PLUS H2 PLUS H3 IONS ON METAL SURFACES
E. O. Rausch and E. W. Thomas 1977 5 p refs Sponsored in part by ERDA
(ORO-2591-85) Avail: NTIS HC A02/MF A01

The H sub beta line emission from backscattered excited H atoms when polycrystalline Mo and Cu targets were bombarded by 20-200 keV H(+), H2(+) and H3(+) ions. The line profile yielded information of the distribution in speed and angle of the particles, whereas the integrated line intensity per incident nucleon was related to the backscattered flux in the excited state j. It is shown that the measured emission coefficient (Balmer beta photons per nuclear incident) is proportional to the predicted excitation coefficient (reflected atoms in the n=4 state per nuclear incident). DOE

N79-15779# Cambridge Univ. (England). Cavendish Lab.
RAMAN SCATTERING FROM GRAPHITE INTERCALATED WITH RUBIDIUM
S. A. Solin (Chicago Univ., Ill.) 1977 14 p refs Sponsored by DOE
(COO-2126-39; Conf-770587-2) Avail: NTIS HC A02/MF A01

Room temperature Raman spectra of C8Rb and C12nRb n = 2...6 and possibly 9 were obtained. For n less than or equals 3 the Raman doublet at approximately 1600/cm was computer fit with a pair of Lorentzian lines. The ratio of the integrated intensities of the components of the doublet varies linearly with n and is zero at n = 2 in agreement with the nearest layer model of Nemanich, Solin and Guerard. The ratio of the Raman scattering cross sections for type C and B layers is sigma sub C/sigma sub B = 0.3 plus or minus 0.1. DOE

N79-15780# Oak Ridge National Lab., Tenn.
A METHOD OF GENERATING MULTIGROUP TRANSFER MATRICES USING AN ANALYTIC ANGULAR INTEGRATION FREE OF TRUNCATION ERROR
J. A Bucholz Sep. 1978 47 p refs Sponsored by U.S. Nuclear Regulatory Comm.
(PB-287228/1; ORNL-NUREG-CSD-8; NUREG-CR-0295) Avail: NTIS HC A03/MF A01 CSCL 20H

The evaluation of generalized multigroup transfer matrices for transport calculations required a double integration extending over the primary and secondary energy groups where, for a given initial energy, the integration over the secondary energy group may be replaced by an integral over the possible scattering angles. The XLACS and MINX cross section processing codes are reviewed along with their weaknesses. Analytic expressions for angular integrals are derived which are free of truncation error. Straightforward extensions to include inelastic and/or anisotropic scattering are included. FORTRAN routines are provided for nuclides having isotropic elastic scattering in the center-of-mass system. GRA

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N79-15781# Naval Research Lab., Washington, D. C. Experimental Plasma Physics Branch.
A QUALITATIVE DESCRIPTION OF THE MODIFIED TRITON ELECTRON BEAM ACCELERATOR
J. D. Sethian Jun. 1978 14 p refs
(AD-A057690; AD-E000182; NRL-MR-2785) Avail: NTIS HC A02/MF A01 CSCL 20/7

The reversed field magnetic confinement geometry generated with plasma currents induced by a rotating relativistic electron beam was studied. The decay of the configuration, although consistent with classical processes, was, because of the low plasma electron temperatures, comparable to the free streaming end loss time. Thus, in order to achieve the higher electron temperatures required to verify axial containment, it was necessary to increase the energy of the relativistic electron beam. It was also desirable to decrease the beam rise time and fall time, in order to increase the strength of the field-reversing current layer; and to decrease the shot-to-shot variation in the beam characteristics. These objectives were achieved by modifying the pulse forming network and prepulse switch of the existing TRITON accelerator. DOE

N79-15782# Naval Research Lab., Washington, D. C. Plasma Physics Div.
STEADY STATE TRANSPORT OF HIGH CURRENT BEAMS IN A FOCUSED CHANNEL Interim Report

I. Haber and A. W. Maschke (Brookhaven Natl. Lab.) May 1978 13 p refs
(NRL Proj. 77H02-58A)
(AD-A059882; AD-E000205; NRL-3787) Avail: NTIS HC A02/MF A01 CSCL 20/7

The possibility of using a heavy ion beam to ignite an inertially confined pellet to thermonuclear temperatures increased the importance of transporting high current beams of charged particles. Though the required beam ignition power and energy can be achieved using relatively modest extensions of present technology, any instabilities in the beam being transported that occur as extrapolation is made to higher current, represent a major barrier to be overcome. Extensive analysis of the transverse behavior of a transported beam in the presence of space charge effects was conducted by numerically integrating the Kapchinskij-Vladimirskij (K-V) envelope equations. The solutions thus obtained was found to be unstable to several classes of perturbations. Evidence is presented here, through the use of computer simulations, that these instabilities saturate and a steady state evolves in which the beam remains stable over a scale of hundreds of transport lenses. Author

N79-15783# Los Alamos Scientific Lab., N. Mex.
ENVIRONMENTAL AND RADIOLOGICAL SAFETY STUDIES. INTERACTION OF (Pu-238)O2 HEAT SOURCES WITH TERRESTRIAL AND AQUATIC ENVIRONMENTS Progress Report, 1 Jul. - 30 Sep. 1977
Glenn R. Waterbury (comp.) Nov. 1977 30 p refs
(Contract W-7405-eng-36)
(LA-7033-PR) Avail: NTIS HC A03/MF A01

The effects of terrestrial and aquatic environments on the containers for heat sources in radioisotope thermoelectric generators was investigated in order to obtain data for designing even safer systems. Topics covered include: analysis of data from environmental chamber experiments that simulate terrestrial conditions, experiments to measure PuO2 dissolution rates, and soil column experiments to measure sorption of plutonium by soils. Several aquatic experiments are described. DOE

N79-15784# National Bureau of Standards, Washington, D. C. Radiation Physics Div.
MONTE CARLO STUDIES OF ELECTRON AND PHOTON TRANSPORT AT ENERGIES UP TO 1000 MeV
Stephen M. Seltzer Jul. 1978 50 p refs Sponsored by Navy
(PB-286933/7; NBSIR-78-1534) Avail: NTIS HC A03/MF A01 CSCL 20H

Calculations of electron-photon showers initiated by electron beams with energies from 50 to 1000 MeV are reported. Results obtained with the Monte Carlo program ETRAN are presented for diverse problems including: (1) the spatial distribution of energy deposited in water, air and lead targets; (2) the escape of scattered electrons and secondary bremsstrahlung from air and lead targets;(3) energy-loss straggling of primary electrons in air; (4) depth-dependent electron spectra (differential tracklength distributions) in air. GRA

N79-15785# Nuclear Regulatory Commission, Washington, D. C. Office of Nuclear Regulatory Research.
DOSIMETRY METHODS FOR FUELS, CLADDING, AND STRUCTURAL MATERIALS, VOLUME 1
Aug. 1978 499 p refs Presented at 2d ASTM-EURATOM Symp. on Reactor Dosimetry, Palo Alto, Calif., 3-7 Oct. 1977 Sponsored in part by EPRI, Palo Alto, Calif. 3 Vol.
(PB-287326/3; NUREG-CP-0004-1) Avail: NTIS HC A21/MF A01; also available in set of 3 reports HC E15 as PB-287388-SET CSCL 18D

A forum for the exchange of new and critical information concerning methods and applications of neutron dosimetry for materials irradiation studies, and the influence of the neutron energy spectrum upon materials damage response is provided. The goals are to facilitate the exchange of information, to coordinate efforts to improve dosimetry and analysis methods, and to ultimately obtain international standardization of these models. Major topics reviewed include: dosimetry for structural materials irradiations; fuel element dosimetry - pre- and during - irradiation; post-irradiation analysis of nuclear fuels. GRA

N79-15786# Nuclear Regulatory Commission, Washington, D. C. Office of Nuclear Regulatory Research.
DOSIMETRY METHODS FOR FUELS, CLADDING, AND STRUCTURAL MATERIALS, VOLUME 2
Aug. 1978 488 p refs Presented at 2d ASTM-EURATOM Symp. on Reactor Dosimetry, Palo Alto, Calif., 3-7 Oct. 1977 Sponsored in part by EPRI, Palo Alto, Calif. 3 Vol.
(PB-287327/1; NUREG-CP-0004-2) Avail: NTIS HC A21/MF A01; also available in set of 3 reports HC E15 as PB-287388-SET CSCL 18D

The data, methods, and techniques used to characterize the neutron environment, and the utilization of well-characterized neutron fields for irradiation programs on fuels, cladding, and structural materials are emphasized. Major topics include: determination of neutron spectra; techniques; nuclear data and standards for dosimetry; workshop reviews and conclusions. GRA

N79-15787# Nuclear Regulatory Commission, Washington, D. C. Office of Nuclear Regulatory Research.
DOSIMETRY METHODS FOR FUELS, CLADDING, AND STRUCTURAL MATERIALS, VOLUME 3
Aug. 1978 488 p refs Presented at 2d ASTM-EURATOM Symp. on Reactor Dosimetry, Palo Alto, Calif., 3-7 Oct. 1977 Sponsored in part by EPRI, Palo Alto, Calif. 3 Vol.
(PB-287328/9; NUREG-CP-0004-3) Avail: NTIS HC A21/MF A01; also available in set of 3 reports HC E15 as PB-287388-SET CSCL 18D

The following workshops are included; workshop on dosimetry materials - procurement, fabrication, and assay; workshop on high-energy neutron dosimetry; workshop on dosimetry for light water reactor pressure vessel surveillance programs; workshop on utilization of benchmark neutron fields;workshop on standardization of fission product yields; workshop on computer codes for unfolding neutron spectra. GRA

N79-15788# Battelle Columbus Labs., Ohio.
EVALUATING STRENGTH AND DUCTILITY OF IRRADIATED ZIRCALOY, TASK 5 Quarterly Progress Report, Jan. - Mar. 1978
A. A. Bauer, W. J. Gallagher, L. M. Lowry, and A. J. Markworth Jun. 1978 56 p refs
(Contract AT(49-24)-0293)
(PB-283521/3; BMI-2000) Avail: NTIS HC A04/MF A01 CSCL 18J

Bend tests were conducted on H. B. Robinson and first-cycle Oconee claddings. Cladding from the higher burnup H. B. Robinson rods has slightly higher strength than the Oconee cladding. Revised strain calculations (based on complete specimen circumference) were made for the expanding mandrel tests reported in BMI-1992. Strains are reduced by almost a factor of 10. The lower values are consistent with surface measurements obtained from scribed specimen isothermal tube-burst tests were conducted and the data show the effects of test temperature, strain rate, and annealing. GRA

N79-15789# Nuclear Regulatory Commission, Washington, D. C. Office of International Programs.
PROCEEDINGS FROM THE NRC-IAEA SPENT FUEL STORAGE MEETING
Darrel Eisenhut, T. J. Carter, L. C. Shao, W. R. Butler, and E. Lantz May 1978 400 p refs Meeting held at Bethesda, Md., 28 Feb. - 2 Mar. 1978
(PB-288249/6; NUREG-0448) Avail: NTIS HC A17/MF A01 CSCL 18G

Emphasis of the meeting was placed on NRC safety reviews of proposed modification to existing reactor spent fuel pools to increase their storage capacity. GRA

74 OPTICS

Includes light phenomena.

N79-15790# Wyoming Univ., Laramie. Dept. of Physics and Astronomy.
DETERMINATION OF THE OPTICAL PROPERTIES OF

HOLLOW GLASS SPHERE AEROSOLS Final Report, 28 Apr. 1977 - 28 Jul. 1978
Todd A. Cerni and Theodore J. Pepin 28 Jul. 1978 41 p
(Contract N00019-77-C-0262)
(AD-A060442) Avail: NTIS HC A03/MF A01 CSCL 20/6

Optical modeling of hollow glass sphere aerosols was undertaken with a two stage approach. The first stage was to develop a model for homogeneous or solid spheres. This was a logical means of proceeding, since modeling of homogeneous spheres is by far the easier of the two tasks and is the area which has received by far the greatest attention from other investigators, hence providing copious examples with which to check our results. The homogeneous glass sphere model, based on the formulation of Mie (1908), was developed without any serious problems and was successfully tested. The second stage of development of optical models consisted of the much more difficult task of developing a model for composite or hollow spheres. The modeled aerosol consists of two concentric spheres composed of two different materials. Results are very different in appearence from those of the solid glass spheres. Qualitatively, this departure can be understood as a combination of two phenomena, a solid sphere of variable refractive index at large aerosol radii and a thin film interference phenomenon at small aerosol radii. GRA

N79-15791# University of Southern Calif., Los Angeles. Image Processing Inst.
DIGITAL COLOR IMAGE COMPRESSION IN A PERCEPTUAL SPACE Final Report, Jan. 1977 - Feb. 1978
Harry C. Andrews and Charles F. Hall Wright-Patterson AFB, Ohio AFAL Jul. 1978 238 p refs
(Contract F33615-77-C-1016; AF Proj. 2003)
(AD-A060431; AFAL-TR-78-80) Avail: NTIS HC A11/MF A01 CSCL 20/6

Simple mathematical models are developed from the physiological and psychophysical traits of the human visual system. Expressions for the statistical characterization of these models are obtained. When used as a preprocessor, the models are shown to produce images which are statistically compatible with the underlying assumptions necessary to solve the parametric rate-distortion equations. The derived power spectrum equations were used to code black and white and color images with a quality superior to previous results. In addition, it is shown that the preprocessor produces a 'perceptual space' in which normalized mean square error is an effective image quality measure. Author (GRA)

N79-15792# Honeywell, Inc., Minneapolis, Minn. Systems and Research Center.
PROTOTYPE AUTOMATIC TARGET SCREENER Quarterly Progress Report, 1 Apr. - 30 Jun. 1978
D. E. Soland, P. M. Narendra, R. C. Fitch, D. V. Serreyn, and T. G. Kopet Sep. 1978 110 p
(Contract DAAK70-77-C-0248; DA Proj. 1E2-63710-DK-70)
(AD-A060850; HONEYWELL-78SRC54-3; QPR-3) Avail: NTIS HC A06/MF A01 CSCL 17/5

This report is the third quarterly progress report for contract DAAK70-77-C-0248, Prototype Automatic Target Screener. The objective of the effort is to design an automatic target screener to be used with thermal imaging systems employing common module components. Author (GRA)

N79-15793# Science Applications, Inc., Sunnyvale, Calif.
FEASIBILITY STUDY FOR PERFORMING AN X-RAY ATTENUATION MEASUREMENT Final Report, 1 Feb. 1977 - 28 Feb. 1978
R. I. Miller 31 Mar. 1978 52 p
(Contract DNA001-77-C-0158)
(AD-A059918; AD-E300334; DNA-4466F) Avail: NTIS HC A04/MF A01 CSCL 13/11

The feasibility of performing an X-ray attenuation measurement to determine the time-dependent density and composition of material in a pipe through which a multikilobar air shock is driven was investigated. A flash X-ray system has the potential to generate adequate signal levels in direct viewing solid state detectors and in scintillator-photomultipliers observing irradiated fluorescers. The major problem is the design of a line-of-sight protection system which can adequately withstand kilobar pressures. A minimal experimental effort on hybla gold verified both adequately low background levels and detector survivability for the required few milliseconds. Author

N79-15794# Army Missile Research and Development Command, Redstone Arsenal, Ala. High Energy Laser and Research Lab.
IMAGE PROCESSING APPLICATIONS OF THE LIQUID CRYSTAL LIGHT VALVE
J. Lynn Smith 12 Jun. 1978 31 p
(AD-A060666; DRDMI-H-78-9) Avail: NTIS HC A03/MF A01 CSCL 20/6

The liquid crystal light valve (LCLV) is employed toward three distinct real-time applications in coherent optical processing. First, it is demonstrated that a real-time system for resolution improvement of distant objects (whose spin Doppler-encodes reflected laser light) is feasible. Secondly, a method for obtaining range-slice images of laboratory models is shown. Further processing, which leads to simulated range-Doppler reference images (like those obtainable from microwave radar), is then demonstrated. The third application of the LCLV uses the device integration time to discriminate dramatically between moving and static speckle in an input image. Real-time image discrimination of slowly moving, laser-illuminated camouflage is therefore possible. Author (GRA)

N79-15795# Army Research Inst. for the Behavioral and Social Sciences, Alexandria, Va.
EVALUATION OF THE SINGER NIGHT VISUAL SYSTEM COMPUTER-GENERATED IMAGE DISPLAY ATTACHED TO THE UH-1 FLIGHT SIMULATOR Final Report
James A. Bynum Sep. 1978 52 p
(AD-A060566; ARI-RR-1199) Avail: NTIS HC A04/MF A01 CSCL 20/6

This report documents a 4-month evaluation of the Singer Computer-Generated Image, Night Visual System Independent Research and Development (IR and D) Display, attached to the UH-1 Flight Simulator. An instructor pilot evaluation of the system rated it acceptable for further tests, and a transfer of training study was run with Initial Entry Rotary Wing (IERW) students as subjects. Five night maneuvers were taught in the simulator and transferred to the helicopter. Trials to criterion and instructor ratings of performance were compared for experimental and control groups. No transfer effect was observed. Problems incurred in device integration and test management are discussed and recommendations are made for alterations for further tests. Author (GRA)

N79-15796# Weapons Research Establishment, Salisbury (Australia).
COMPUTATION OF THE PERFORMANCE OF OPTICAL INTERFERENCE FILTERS USED IN FOCUSED OPTICAL SYSTEMS HAVING AN EXTENDED FIELD OF VIEW
M. S. Brown Mar. 1978 31 p
(AD-A060830; WRE-TR-1949(A)) Avail: NTIS HC A03/MF A01 CSCL 20/6

The computation of the effective spectral transmission of an interference filter when it is used in the focused beam of an optical system with an extended field of view is described. The performance of a Fabry-Perot filter in a typical lens system is discussed. Author (GRA)

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N79-15797*# Old Dominion Univ. Research Foundation, Norfolk, Va.
FISSION-INDUCED PLASMAS Final Report, 15 Dec. 1976 - 15 Dec. 1977
W. L. Harries and Yuehjaw J. Shiu Jan. 1979 50 p refs
(Grant NsG-1362)
(NASA-CR-158061; PTR-79-1) Avail: NTIS HC A03/MF A01 CSCL 20I

The possibility of creating a plasma from fission fragments, and to utilize the energy of the particles to create population inversion that would lead to laser action is investigated. An investigation was made of various laser materials which could be used for nuclear-pumped lasing. The most likely candidate for a fissioning material in the gaseous form is uranium hexafluoride - UF6, and experiments were performed to investigate materials that would be compatible with it. One of the central problems in understanding a fission-induced plasma is to obtain a model of the electron behavior, and some preliminary calculations are presented. In particular, the rates of various processes are discussed. A simple intuitive model of the electron energy distribution function is also shown. The results were useful for considering a mathematical model of a nuclear-pumped laser. Next a theoretical model of a (3)He-Ar nuclear-pumped laser is presented. The theory showed good qualitative agreement with the experimental results. L.S.

N79-15798# Maryland Univ., College Park. Dept. of Physics and Astronomy.

STABILITY PROPERTIES OF A CYLINDRICAL ROTATING P-LAYER IMMERSED IN A UNIFORM BACKGROUND PLASMA

Han S. Uhm and Ronald C. Davidson (DOE, Washington D.C.) 1978 34 p refs

(Contract N00014-75-C-0309)

(AD-A060378) Avail: NTIS HC A03/MF A01 CSCL 18/1

The electrostatic stability properties of a rotating, charge-neutralized P-layer are investigated within the framework of a hybrid (Vlasov-fluid) model in which the layer ions are described by the Vlasov equation, and the layer electrons and the uniform background plasma are described as macroscopic, cold fluids. It is assumed that the P-layer is thin, with radial thickness (2a) much smaller than the mean radius (R sub 0), and that nu -- 1, where nu is Budker's parameter for the layer ions. Electrostatic stability properties are calculated for perturbations about a weakly diamagnetic P-layer with rectangular density profile. The stability analysis is carried out including the effects of a uniform background plasma, and weak self magnetic fields. Although a slow rotational P-layer (P sub 0 = 0) is found to be stable, it is shown that a fast rotational P-layer (P sub 0 0) is unstable for sufficiently high background plasma density ((omega sub p) squared = = (omega sub ci) squared). The typical instability growth rate is a substantial fraction of the ion cyclotron frequency. GRA

N79-15799# Naval Research Lab., Washington, D. C.

LINEAR STABILITY OF SELF-SIMILAR FLOW. 4. CONVECTIVE INSTABILITY OF A SPHERICAL CLOUD EXPANDING INTO VACUUM Interim Report

D. L. Book Oct. 1978 18 p refs

(RR0110941)

(AD-A060835; NRL-MR-3852) Avail: NTIS HC A02/MF A01 CSCL 20/9

The well-known class of self-similar solutions for an ideal polytropic gas sphere of radius R(t) expanding into a vacuum with velocity u(r,t) = r R-dot/R is shown to be convectively unstable. The physical mechanism results from the buoyancy force experienced by anisentropic distributions in the inertial gravitational field. An equation for the perturbed displacement, derived from the linearized fluid equations in Lagrangian coordinates, is solved by separation of variables. Because the basic state is nonsteady, the perturbations do not grow exponentially, but can be expressed in terms of hypergeometric functions. GRA

N79-15800# Colorado State Univ., Fort Collins. Dept. of Electrical Engineering.

INVESTIGATIONS ON THE DYNAMICS OF MHD FLOWS Final Technical Report

H. E. Wilhelm 10 Jan. 1978 53 p refs

(Contract N00014-76-C-0985)

(AD-A058330) Avail: NTIS HC A04/MF A01 CSCL 20/9

Exact similarity solutions were derived for the incompressible flow of electrically conducting, viscous fluids across homogeneous, axial magnetic fields, and nonuniform, azimuthal magnetic fields in diffusers with plane walls. The velocity distributions in the MHD diffusers, the onset of flow separation, and the control of separation by means of magnetic fields are discussed under consideration of induced magnetic fields and viscous stress relaxation. The Stark effect and (absorbtion) satellite spectra in helium plasma flows with homogeneous magnetic fields are calculated in the presence of laser radiation. DOE

N79-15801# Naval Research Lab., Washington, D. C.

LINEAR STABILITY OF SELF SIMILAR FLOW. 3: COMPRESSIONAL WAVES IN IMPLODING SPHERICAL SHELLS Interim Report

David L. Book May 1978 14 p

(AD-A060806; AD-E000224; NRL-MR-3799) Avail: NTIS HC A02/MF A01 CSCL 18/1

A new, potentially disruptive, phenomenon in target pellets irradiated by laser or particle beams is described. Initially weak standing sound waves (vibrations) in an imploding spherical shell can become comparable in amplitude with the shell thickness if the effective adiabatic index satisfies gamma - 5/3. Detailed calculations with a soluble self-consistent model show the relative amplification is strongest for long-wavelength modes in thin shells with small gamma, and is insensitive to the density profile. Author (GRA)

N79-15802# Addis Translations International, Portola Valley, Calif.

TRANSPORT OF CESIUM OUT OF SURFACE-PLASMA SOURCES OF H(-) IONS

Yu. I. Belchenko, V. I. Davydenko, G. E. Derevyankin, A. F. Dorogov, and V. G. Dudnikov Aug. 1977 8 p refs Transl. into ENGLISH from Nuclear Phys. Inst., USSR Acad. of Sci. Preprint IYAF-77-18 (Novosibirsk), 1977 7 p Prepared for California Univ., Livermore. Lawrence Livermore Lab.

(UCRL-Trans-11267; IYAF-77-18) Avail: NTIS HC A02/MF A01

Under pulsed conditions, the main consumption of cesium supplied to a gas discharge chamber to reduce the work function of the electrodes is caused by the transport of cesium through the emission hole at the end of the discharge pulses and is determined by the electrode temperature. Generation of negative hydrogen ion beams with a pulse intensity of 0.1A, pulse length of 250 micron second and pulse rate of 100 Hz is achieved at an average cesium consumption of one thousandth g/h. Because of the blocking of cesium at electrodes with a negative potential by a dense plasma opaque to cesium atoms, a low consumption of cesium under steady and quasi-steady operating conditions can be expected. DOE

N79-15803# Addis Translations International, Portola Valley, Calif.

CONFINEMENT OF PLASMA IN A PURELY TOROIDAL MAGNETIC TRAP WITH A SELF-CONSISTENT ELECTRIC FIELD

D. G. Bulyginskii, V. S. Yuferev, and E. V. Galaktionov Sep. 1977 17 p refs Transl. into ENGLISH of preprint no. 545, A. F. Iofpetech. Phys. Inst., USSR Acad. of Sci., Leningrad, 1977 17 p Sponsored by DOE

(UCRL-Trans-11280) Avail: NTIS HC A02/MF A01

A possible mechanism for the formation of an equilibrium plasma configuration of a currentless toroidal pinch enclosed in a conducting chamber in a toroidal magnetic field is described. The rotation of the plasma with respect to the azimuth of the minor section in crossed fields acts as the rotational transformation. Electric fields of sufficient intensity are formed automatically as a result of charge separation caused by toroidal drift or as a result of predominant losses of particles of the same sign. The macroscopic force balancing the uncompensated part of the gas kinetic pressure along the major radius is the force of interaction of the excess plasma charge with the charge of the image on the inner wall of the conducting chamber. It is shown as an estimate that this does not require very high fields if the polarizability of a dense plasma is taken into account. A.R.H.

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

N79-15804*# Rensselaer Polytechnic Inst., Troy, N. Y.
GROWTH OF SINGLE CRYSTALS BY VAPOR TRANSPORT Final Technical Report, Jun. 1970 - Oct. 1978
Heribert Wiedemeier Nov. 1978 22 p refs
(Contract NAS8-26146)
(NASA-CR-150898) Avail: NTIS HC A02/MF A01 CSCL 20L

The primary objectives of the program were to establish basic vapor transport and crystal growth properties and to determine thermodynamic, kinetic and structural parameters relevant to chemical vapor transport systems for different classes of materials. An important aspect of these studies was the observation of the effects of gravity-caused convection on the mass transport rate and crystal morphology. These objectives were accomplished through extensive vapor transport, thermochemical and structural studies on selected Mn-chalcogenides, II-VI and IV-VI compounds. Author

N79-15805# RCA Labs., Princeton, N. J.
EPITAXIAL GROWTH OF SEMI-INSULATING Ga-As Annual Report, 1 Jul. 1977 - 30 Jun. 1978
S. T. Jolly, D. S. Yaney, S. G. Lin, C. P. Wu, and S. Y. Narayan Mar. 1978 57 p refs
(Contract N00014-77-C-0542; DARPA Order 3441)
(AD-A060064; PRRL-78-CR-38) Avail: NTIS HC A04/MF A01 CSCL 20/12

The objective of the program is to develop techniques for the vapor phase growth of high resistivity epitaxial layers of GaAs on semi-insulating (SI) GaAs substrates. A capability to grow high resistivity buffer layers with minimum structural defects prior to the growth of active device layers would eliminate device performance problems caused by poor and inconsistent substrate quality. During the program a reactor and its associated gas handling system was built. Both undoped and chromium doped high resistivity epitaxial layers were grown with excellent surface morphology. In order to determine the properties of the material grown, a parallel effort in material characterization has been carried out. This effort has included measurement of electrical and photoconductive properties as well as the employment of various analytical techniques to determine the concentrations of chromium introduced during the material growth. GRA

N79-15806# Naval Research Lab., Washington, D. C. Electronics Technology Div.
ELECTRONIC MATERIALS TECHNOLOGY (SEMICONDUCTORS) Summary Report, 1 Jul. 1976 - 30 Apr. 1978
Edward M. Siggard and Howard Lessoff Aug. 1978 67 p refs
(ZF54581001)
(AD-A060363; NRL-MR-3845) Avail: NTIS HC A04/MF A01 CSCL 20/12

High purity GaAs has been compounded in pyrolytic boron nitride (PBN) ware. Semi-insulating GaAs single crystals have been grown by the liquid encapsulation technique. High purity InP has been compounded in PBN boats and single crystals of InP have been grown by the high pressure liquid encapsulation technique. Liquid phase epitaxial layers of GaAs have been grown on a semi-insulating substrate that has been etched with an in-situ gallium etch prior to growth. Author (GRA)

N79-15807# Naval Research Lab., Washington, D. C. Semiconductors Branch.
FREQUENCY DEPENDENCE OF DIELECTRIC LOSS IN CONDENSED MATTER Memorandum Report, May 1977 - Jun. 1978
K. L. Ngai and C. T. White Sep. 1978 33 p refs
(RR0110242)
(AD-A060368; NRL-MR-3863) Avail: NTIS HC A03/MF A01 CSCL 20/12

The dielectric response of condensed matter below microwave frequencies has been known to depart from the Debye behavior, sometimes to the point of being unrecognizable and yet the generally accepted interpretations of the departures have seldom deviated from the Debye philosophy of simple relaxation phenomena in non-interacting systems. It was recently recognized, from a synoptic view of the experimental data involving a wide range of materials, that there exists a remarkable universality of dielectric response behavior regardless of physical structure, types of bonding, chemical type, polarizing species and geometrical configurations. This strongly suggests that there should exist a correspondingly universal mechanism of dielectric polarization in condensed matter. The present work proposes such a universal mechanism associated with the existence of some ubiquitous very low energy excitations in the system. These excitations exhibit an infrared divergent-like response to transitions of the polarizing species induced by a time-varying electric field in the dielectric and give rise to the universal dielectric response. Author (GRA)

N79-15808# California Univ., San Diego, La Jolla. Dept. of Physics.
LOCAL THEORY OF ELECTRONIC STRUCTURE OF EXTENDED SYSTEMS Technical Report, 1 Jan. - 26 Sep. 1978
Avishay Yaniv and Walter Kohn Sep. 1978 37 p refs
(Contract N00014-76-C-0050)
(AD-A060885; TR-46) Avail: NTIS HC A03/MF A01 CSCL 20/12

A theory of local electronic structure is presented which yields the local density of states n(r,E) and related quantities. The theory applies whether the electronic wave functions themselves are delocalized or not and requires a knowledge of the Hamiltonian only in the vicinity of r. Several simple examples are worked out with good results. Possible applications include periodic and non-periodic transition metal systems and large molecules. GRA

N79-15809# IBM Watson Research Center, Yorktown Heights, N.Y.
STUDY OF THE PHYSICS OF INSULATING FILMS AS RELATED TO THE RELIABILITY OF METAL-OXIDE SEMICONDUCTOR DEVICES Interim Report, 17 May - 16 Nov. 1977
D. R. Young, E. A. Irene, D. W. Dong, D. J. Dimaria, R. F. DeKeermaecker, Z. A. Weinberg, G. Rubloff, W. R. Hunter, and C. M. Serrano Griffiss AFB, N. Y. RADC May 1978 103 p refs
(Contract F19628-76-C-0249; ARPA Order 2180; AF Proj. 2306; AF Proj. 2180)
(AD-A060942; RADC-TR-78-115; SCIENTIFIC-3) Avail: NTIS HC A06/MF A01 CSCL 20/12

The current papers describe the oxidation of heavily doped silicon, the location of implanted ions in SiO2, a light activated storage device (LASD) and exciton model for Si-SiO2 interface state generation and electron trapping and photo detrapping on sites related to As implantation in SiO2. Author (GRA)

N79-15810# Advanced Research and Applications Corp., Sunnyvale, Calif.
IMPROVEMENT IN THE GaAs DEVICE YIELD AND PERFORMANCE THROUGH SUBSTRATE DEFECT GETTERING
T. J. Magee, J. Peng, and J. Hong Oct. 1978 45 p refs
(Contract N00014-78-C-0065)
(AD-A060728; ARACOR-19-1) Avail: NTIS HC A03/MF A01 CSCL 20/12

The use of mechanically produced back-surface-damage as a means of gettering impurities and defects in GaAs wafers has been investigated. Comparative analyses have been done on both ion implantation and mechanical back-surface-damage gettering techniques. The increased thermal stability of mechanically produced damage has shown ion implantation techniques to be less effective for gettering over long anneal periods at elevated temperatures. For anneals at 800 C for periods less than 5 hrs, stress gradients produced by graded dislocation distributions produce reductions in front surface defect concentrations and effective gettering of Au and Cr at the back surface. For anneal times exceeding the thermal stability time reverse gettering or impurity detrapping occurs at the back surface. Front-surface encapsulating layers have also been shown to exercise a small but perceptible effect related in part to the concentration of As and/or Ga vacancies in the interfacial region. Author (GRA)

N79-15811# National Bureau of Standards, Washington, D. C. Center for Materials Science.
APPLICATIONS OF SPACE FLIGHT IN MATERIALS

SCIENCE AND TECHNOLOGY
Shirleigh Silverman and Elio Passaglia Sep. 1978 132 p refs Conf. held at Gaithersburg, Md., 20-21 Apr. 1977
(PB-286957/6; NBS-SP-520; LC-78-600074) Avail: NTIS HC A07/MF A01 CSCL 20L

Experiments carried out on Skylab, the Apollo-Soyuz Test Project, and recent sounding rocket experiments were reviewed. Specific discussions were directed at possible future applications in metals and alloys, ceramics, semiconductor materials, biological materials, crystal growth, transport properties, critical phenomena, thermodynamic data, containerless processing, combustion, and convection effects. GRA

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

N79-15812# California Univ., San Diego, La Jolla. Dept. of Physics.
LOCALITY PRINCIPLE IN WAVE-MECHANICS (WAVE MECHANICS/LOCAL DENSITY OF STATES/LOCAL PARTITION FUNCTION/CLUSTER METHODS/MOMENT METHODS/PATH INTEGRAL METHODS) Technical Report, 1 Jan. - 25 Oct. 1978
Walter Kohn and Avishay Yaniv Oct. 1978 15 p refs
(Contract N00014-76-C-0050)
(AD-A060884; TR-47) Avail: NTIS HC A02/MF A01 CSCL 20/10

This paper proves a locality principle for a wave-mechanical particle governed by the Schroedinger equation. It is shown that rho(r,Beta), the Laplace transform of the local density of states n(r,E), depends significantly only on the potential V(r') at points r' near r. The effect of changes of V(r') at distant points r' (abs. val. (r' - r) = d) on rho(r,Beta), decay in a Gaussian fashion with a. This result sheds some light on the locality of physical properties of extended systems and provides general support for various local methods of calculation. Author (GRA)

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

N79-15813*# North Carolina Agricultural and Technical State Univ., Greensboro. Dept. of Electrical Engineering.
A RESEARCH FEASIBILITY STUDY PROPOSAL FOR CONDUCTING EXPERIMENTAL RESEARCH IN CURRICULUM SHARING VIA COMMUNICATIONS TECHNOLOGY SATELLITE AMONG INSTITUTIONS HAVING LARGE MINORITY ENROLLMENTS Final Report, 14 Apr. 1977 - 31 Aug. 1978
Leo Williams, Jr. Sep. 1978 50 p refs
(Contract NAS5-24101)
(NASA-CR-159903) Avail: NTIS HC A03/MF A01 CSCL 05I

The applicability of the tele-conference method of curriculum sharing as well as the sharing of scientific research results between universities and industrial organizations was evaluated in relation to other techniques and methods. Ten universities cooperated with NC A&T State University in an effort to increase the number of minority scientists and engineers in the USA via the utilization of the communication features of satellites. Research activities, experiments and studies in curriculum sharing are described as well as the techniques, interconnections and equipment utilized. Suggested methods and recommendations for a continuation of innovative applications of satellite technology in higher education at NC A&T State University are included. A.R.H.

N79-15814# National Science Foundation, Washington, D. C. Directorate for Science Education.
CONTINUING EDUCATION IN SCIENCE AND ENGINEERING Final Report
Dec. 1977 262 p refs
(PB-286213/4; SE-78-5) Avail: NTIS HC A12/MF A01 CSCL 05I

An analysis of information on the employment and availability of scientific and engineering personnel, an account of an experts' conference in August, 1977, and six commissioned papers are reported. Three generalizations may be ventured from the many complex ideas presented: (1) 'continuing education' has become distinguished from advanced education, i.e., is for maintaining or diversifying skills of employed professionals; (2) course-taking is less significant in continuing education than elements of the work environment, e.g., job design, supervision, and incentive systems; (3) although no clear national need emerges to justify federal subsidy of delivery of continuing education, studies, research and policy analysis are suggested to better understand the problem and further specify the federal role. GRA

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N79-15815# Committee on Science and Technology (U. S. House).
UNITED STATES CIVILIAN SPACE PROGRAMS: AN OVERVIEW
Marcia S. Smith, George N. Chatham, Christopher H. Dodge, Barbara A. Luxenberg, Leni H. Raleigh, and Charles S. Sheldon, II Washington GPO 1979 180 p refs Rept. for Subcomm. on Space Sci. and Applications of the Comm. on Sci. and Technol., 95th Congr., 2d Sess., Dec. 1978 Prepared by the Library of Congr., Congressional Res. Service
(GPO-35-823) Avail: SOD HC

An overview of NASA's history and its relationship to U.S. space policy is presented as well as a synopsis of the achievements and benefits derived from a many-faceted nonmilitary space program. Issues identified for congressional consideration of specific elements of a cohesive space policy relate to: (1) NASA as an organization; (2) NASA centers and facilities; (3) launch vehicles and propulsion; (4) applications satellites; (5) NASA tracking stations and the TDRSS; (6) space shuttle; (7) space sciences; (8) space life sciences; (9) materials processing in space; (10) international space programs; (11) domestic technology utilization; and (12) NASA university support. A.R.H.

N79-15816# Texas A&M Univ., College Station. Inst. of Statistics.
STATISTICAL PERT: IMPROVEMENTS IN THE DETERMINATION OF THE PROJECT COMPLETION TIME DISTRIBUTION
Thomas C. Baker, Jr. and Robert L. Sielken, Jr. Aug. 1978 97 p refs
(Contracts N00014-78-C-0426; N00014-68-A-0140)
(AD-A060882; THEMIS-TR-58) Avail: NTIS HC A05/MF A01 CSCL 05/1

This report develops improvements to a new project scheduling procedure, Statistical PERT, being developed at the Institute of Statistics, Texas A and M University. The project scheduling algorithm is a five step iterative procedure capable of determining a minimum cost project schedule when the activities making up the project have durations which are random variables. The cost of an activity is assumed to be a convex piecewise linear function of the activity's mean duration. The problem is to determine the activity mean durations which both minimize the total project cost and insure that the mean (or some specified percentile) of the corresponding project completion time distribution is less than or equal to a specified project deadline. The entire distribution of the project's completion time under the minimum cost schedule is a valuable by-product. GRA

N79-15817# Naval Research Lab., Washington, D. C. Computer Science Lab.

A STUDY OF MANAGEMENT INFORMATION SYSTEM NEEDS FOR THE ELECTROMAGNETIC COMPATIBILITY LABORATORY OF THE NAVAL AIR TEST CENTER

Gerald A. Wilson May 1978 28 p refs

(AD-A057688; AD-E000184; NRL-MR-3775) Avail: NTIS HC A03/MF A01 CSCL 05/1

The requirements and utility of management information systems to support the EMC/EMI effort are reported. Those aspects of the work performed by the EMC lab of NATC which might benefit from the support of a management information system, were investigated and the most cost effective manner for installing such a system was recommended. It was determined that there are two distinct, though closely related, needs for management information which exist in the EMC laboratory of NATC. The first requirement is a system to manage a data base of aircraft equipment and component specifications. This would be used by the engineers and technicians performing EMC/EMI testing and evaluation of aircraft. The second requirement is a management information system to maintain and generate necessary reports. B.B.

N79-15818# Texas A&M Univ., College Station. Inst. of Statistics.

PROJECT SCHEDULING WITH DISCONTINUOUS PIECEWISE CONVEX ACTIVITY COST FUNCTIONS

Christian C. Robieux and Robert L. Sielken, Jr. Sep. 1978 25 p refs

(Contract N00014-78-C-0426)

(AD-A060500; THEMIS-TR-61) Avail: NTIS HC A02/MF A01 CSCL 09/2

When an activity can be performed with different techniques, the activity cost function may be a discontinuous piecewise convex function of the activity's duration. This makes the determination of the minimum cost schedule satisfying a specified project deadline a nonconvex problem. However, if an activity may be performed using a combination of the different techniques, the concept of a convex hull can be used to transform the activity's cost function. The resulting convex problem can be solved by the existing PERT procedures. Therefore, this paper extends the applicability of existing PERT procedures to problems with discontinuous piecewise linear or piecewise convex activity cost functions. Author (GRA)

N79-15819# Texas A&M Univ., College Station. Inst. of Statistics

A USER'S GUIDE TO THE COMPUTER IMPLEMENTATION OF THE NEW PROJECT SCHEDULING PROCEDURE: STATISTICAL PERT

Thomas C. Baker, Jr. and Robert L. Sielken, Jr. Aug. 1978 302 p

(Contract N00014-78-C-0426)

(AD-A060568; THEMIS-TR-57) Avail: NTIS HC A14/MF A01 CSCL 09/2

This report documents a new project scheduling algorithm which is a five step iterative procedure capable of determining a minimum cost project schedule when the activities making up the project have durations which are random variables. The cost of an activity is assumed to be a convex piecewise linear function of the activity's mean duration. The problem is to determine the activity mean durations which both minimize the total project cost and insure that the mean (or some specified percentile) of the corresponding project completion time distribution is less than or equal to a specified project deadline. Information on the trade-off between the project's minimum cost and its specified deadline is also provided. This report is intended as a user's guide to the new project scheduling procedure and its computer implementation. The report includes a description of the project scheduling problem a general overview of the scheduling procedure including references to technical reports documenting the development of the procedure, and an example of the procedure's performance. The documentation of the computer implementation includes specific input instructions; sample input and output; flowcharts; individual program descriptions; technical details concerning temporary data sets, job control language, and program interruption and restart procedures; and program listings. GRA

N79-15820# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.

A PROPOSED CONCEPTUAL MODEL FOR THE INTEGRATION OF ZERO-BASE BUDGETING INTO THE RESOURCE MANAGEMENT SYSTEM AT THE BASE LEVEL M.S. Thesis

Robert J. Conner and David B. Walker Sep. 1978 248 p refs

(AD-A060489; AFIT-LSSR-4-78B) Avail: NTIS HC A11/MF A01 CSCL 05/1

A major impact of zero-base budgeting (ZBB) in the Air Force will be on the role of the base-level managers. The problem for the Air Force is to integrate the philosophy of centralized planning, programming and budgeting with the concept of operating management participation in a bottom-up ZBB process. The objective of this research is to develop a conceptual model of ZBB as it could be applied at base level in the Air Force and to provide support for the appropriateness of the proposed model by using an opinion survey of base-level responsibility center managers and resource advisors. A conceptual model is presented and results of the opinion survey are used to validate aspects of the model. The opinion survey also includes questions pertaining solely to the attitudes of the base-level managers toward the zero-base budgeting process. The conclusion of the research is that, while there are several problems in the implementation of ZBB at base level, the responsible center managers and resource advisors can perform the functions required by ZBB. The proposed model was supported in part by the results of the survey. Recommendations and areas for further study are presented. Author (GRA)

N79-15821# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.

APPLICATION OF LIFE CYCLE COSTING PRINCIPLES TO LESS THAN MAJOR PROGRAMS M.S. Thesis

Joseph P. Culp and Steven D. Novy Sep. 1978 108 p refs

(AD-A060772; AFIT-LSSR-6-78B) Avail: NTIS HC A06/MF A01 CSCL 15/5

This study examined ten current life cycle cost (LCC) procurements of aircraft subsystems and equipment. The objectives of the research were to identify potential LCC problem areas, to consolidate lessons learned from past and on-going LCC-oriented programs, and to provide the basis for development of an improved and simplified LCC guidance document for the program manager. The methodology used was a combination of literature review and interviews with personnel within ASD currently responsible for various aspects of LCC. The interviews focused primarily on program managers, but included others involved with contracting, testing, engineering, and LCC modeling. The study is organized into areas covering early program considerations, models and data inputs, request for proposal and source selection, negotiation, contracting, and incentive considerations, LCC verification testing, and lessons learned.Author (GRA)

N79-15822# Wright State Univ., Dayton, Ohio.

MANPOWER IMPLICATIONS IN THE DESIGN OF AIR FORCE EQUIPMENT Final Report, 1 Jun. 1973 - 31 Aug. 1976

M. L. Ritchie Feb. 1978 7 p

(Grant AF-AFOSR-2569-73)

(AD-A059423; HFE-78-1) Avail: NTIS HC A02/MF A01 CSCL 05/1

The manpower portion of operations and support costs are increasing despite success in establishing principles and the data base upon which Air Force design activities proceed. The problem of influencing engineering design to result in more effective incorporation of operating and supporting cost variables is addressed. The general lack of design education in the preparation of engineers is considered and suggestions are made for changing design procedures and for further research. A.R.H.

N79-15823# National Technical Information Service, Springfield, Va.

DESIGN TO COST AND LIFE CYCLE COSTING, VOLUME 3. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, Dec. 1976 - Nov. 1977

Guy E. Habercom, Jr. Dec. 1978 176 p

(NTIS/PS-78/1249/8) Avail: NTIS HC $28.00/MF $28.00

CSCL 05A

Management control methods for cost effectiveness of systems and systems design are investigated in these research reports. Federal, municipal, and industrial applications of the developed philosophies are reported. GRA

N79-15824# National Technical Information Service, Springfield, Va.

DESIGN TO COST AND LIFE CYCLE COSTING, VOLUME 4. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, Dec. 1977 - Nov. 1978

Guy E. Habercom, Jr. Dec. 1978 246 p Supersedes NTIS/PS-77/1145; NTIS/PS-76/-1036; NTIS/PS-75/875 (NTIS/PS-78/1250/6; NTIS/PS-77/1145; NTIS/PS-76/1036; NTIS/PS-75/875) Avail: NTIS HC $28.00/MF $28.00 CSCL 05A

An updated bibliography containing 238 abstracts, all of which are new entries to the previous edition, is presented. Management control methods for cost effectiveness of systems and systems design are investigated in these research reports. G.Y.

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software.*

N79-15825# Communications Research Centre, Ottawa (Ontario). Technology and Systems Branch.

A GENERAL DESCRIPTION OF TELIDON: A CANADIAN PROPOSAL FOR VIDEOTEX SYSTEMS

H. G. Bown, C. D. OBrien, W. Sawchuk, and J. R. Storey Dec. 1978 29 p refs

(CRC-TN-697-E) Avail: NTIS HC A03/MF A01

Overall system concepts are described for public-accessed, interactive, information retrieval services which use domestic television receivers, suitably modified or supplemented, as terminal equipment to retrieve data (via the common-carrier telephone lines, or other interactive networks) from large computer-based information sources which contain pages of information containing both textual and graphic images. A terminal-independent method of describing images is suggested. Images are described as either alpha-geometric or alpha-photographic images by means of picture description instructions (PDI's). This approach permits the growth of large information bases, through terminal independence, which would not have to change to accommodate new developments and improvements as new technologies become available in the foreseeable future. A.R.H.

N79-15826# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.

TWO PAPERS ON RANGE SEARCHING: A SURVEY OF ALGORITHMS AND DATA STRUCTURES FOR RANGE SEARCHING. EFFICIENT WORST-CASE DATA STRUCTURES FOR RANGE SEARCHING Interim Report

Jon Louis Bentley, Jerome H. Friedman (Stanford Linear Accelerator Center, Calif.), and H. A. Maurer Aug. 1978 48 p (Contract N00014-76-C-0370)

(AD-A060584; CMU-CS-78-136) Avail: NTIS HC A03/MF A01 CSCL 09/2

This report contains two independent papers on range searching. A range search retrieves from a file all records which conjunctively satisfy a set of range requirements for the keys; that is, each key must lie in some specified range. Range searching arises in many applications, such as data base management and statistical computing. The first paper in this report, 'A survey of algorithms and data structures for range searching' by J. L. Bentley and J. H. Friedman, describes the known 'logical structures' which can be used for range searching and then discusses the implementation of those structures in different storage media. This paper is slanted towards the practitioner. The second paper, 'Efficient worst-case data structures for range searching' by J. L. Bentley and H. A. Maurer, is more theoretical. Two new classes of data structures are proposed for range searching, establishing bounds on the asymptotic complexity of the problem. Author (GRA)

N79-15827# Space and Missile Test Center, Patrick AFB, Fla.

DET 1, SAMTEC (EASTERN TEST RANGE) HANDBOOK FOR SCIENTIFIC AND TECHNICAL INFORMATION (STINFO)

Lynn S. Marrs 15 Sep. 1978 18 p

(AD-A060938; SAMTEC/DET-1-TR-78-21) Avail: NTIS HC A02/MF A01 CSCL 05/2

This report is a general reference guide to the DoD, Air Force, and ETR STINFO Programs. It is a compilation of material contained in pertinent STINFO regulations and manuals. The report is designed primarily as a working guide for technical personnel producing or monitoring technical reports, STINFO, and Project Officers at the Eastern Test Range. Author (GRA)

N79-15828# Computer Corp. of America, Cambridge, Mass.

A DISTRIBUTED DATABASE MANAGEMENT SYSTEM FOR COMMAND AND CONTROL APPLICATIONS Semiannual Technical Report, 1 Jan. - 30 Jun. 1978

30 Jun. 1978 133 p refs

(Contract N00039-77-C-0074)

(AD-A060441; CCA-78-10; SATR-3) Avail: NTIS HC A07/MF A01 CSCL 15/7

This report summarizes the third six month period of a project entitled, 'A Distributed Database Management System for Command and Control Applications' which has been undertaken by CCA and sponsored by ARPA-IPTO. The primary focus of this effort is to design and implement a distributed database management system called SDD-1 (System for Distributed Databases). SDD-1 is specifically oriented toward command and control applications and will be installed in phases and tested in the Advanced Command and Control Architectural Testbed (ACCAT) at the Naval Ocean Systems Center (NOSC) in San Diego. The motivation behind building a distributed database management system like SDD-1 is to take advantage of the decreasing cost of distributed processing environments and at the same time respond to the increasing data handling needs of geographically distributed organizations. SDD-1 permits data to be managed on a network of computers in an integrated environment that presents the user with the illusion that he is dealing with a centralized DBMS. GRA

N79-15829# Stanford Univ., Calif. Dept. of Computer Science.

DISTRIBUTED PROBLEM SOLVING: THE CONTRACT NET APPROACH Technical Report, period ending Jun. 1978

Reid G. Smith and Randall Davis Sep. 1978 31 p refs

(Contract MDA903-77-C-0322; Grants NSF MCS-77-02712; RR00785; ARPA Order 2492)

(AD-A060795; SU-STAN-CS-78-667; HPP-78-7) Avail: NTIS HC A03/MF A01 CSCL 09/2

The ongoing revolution in LSI technology is drastically reducing the cost of computer components, making multiple processor architectures economically viable. These architectures have the potential to provide several computational advantages over uniprocessor architectures, including speed, reliability, and efficient matching of available processing power to problem complexity. This has led to a search for problem solving methods which can exploit the new technology. This paper presents one approach to problem solving in such architectures. The paper proposes a model of a distributed problem solver which consists of a collection of processors connected with communications and control mechanisms that enable them to operate concurrently, and enable them to cooperate in solving complex problems. The term 'distributed' rather than 'parallel' is used to emphasize that the individual processors are loosely-coupled; that is, the time a processor node spends in communication is small with respect to the time it spends in computation. GRA

N79-15830# Oak Ridge Associated Universities, Tenn.

COAL RESEARCH: DATA SYSTEMS AND INFORMATION TRANSFER

W. E. Felling, ed. Oct. 1977 22 p Sponsored by ERDA

(ORAU-133; Conf-771207-1) Avail: NTIS HC A02/MF A01

As a consequence of years of minimal support for coal

processing research, only marginal communication occurs between those government agencies and educational institutions concerned with such research. The need for mechanisms by which universities and ERDA energy research centers can regularly communicate with each other and the need for a shared, reliable, and accessible coal data system are assessed. The Department of Energy's Coal Technology Information Center and Technical Information Center at Oak Ridge National Laboratory, RECON, and the Texas A&M University coal information data systems are described.
A.R.H.

N79-15831# Chemical Abstracts Service, Columbus, Ohio.
EXPERIMENT IN DATA TAGGING IN INFORMATION-ACCESSING SERVICES CONTAINING ENERGY-RELATED DATA Final Report, 1975 - 1978
Aug. 1978 79 p
(Grant NSF DSI-75-03491)
(PB-286654/9; CAS-264) Avail: NTIS HC A05/MF A01 CSCL 05B

The use of data tags in a machine-readable output file was considered for incorporation into an on-line search service. Data tags are codes which uniquely identify specific types of numerical data in the corresponding source documents referenced in the file. Editorial and processing procedures were established for the identification of data types; the recording, editing, verification, and correction of the data tags; and their compilation into a special version of ENERGY, a CAS computer-readable abstract text file. Possible data tagging plans are described and criteria for extended studies in data tagging and accessing are outlined.
GRA

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N79-15832# Stanford Univ., Calif. Dept. of Operations Research.
A LINEAR APPROACH FOR SOLVING STOCHASTIC CAPITAL BUDGETING PROBLEMS
Gerhard Schiefer Jul. 1978 28 p refs
(Contract N00014-76-C-0418)
(AD-A060852; SU-TR-80) Avail: NTIS HC A03/MF A01 CSCL 05/3

Capital budgeting problems with linear decision variables that can be either continuous or integer and where some or all of the associated cash flows are random variables that may be statistically dependent are considered. They are formulated as convex chance-constrained programming problems that can be approximated by ordinary (integer or noninteger) linear programming problems. The proposed procedure allows the explicit consideration of decision opportunities dealing with a deficit or surplus in periodic net cash flows such as the accumulation of an optimal cash reserve or appropriate borrowing and lending opportunities and of penalties that have to be paid if periodic deficits do occur or the probability constraints do happen to be violated.
GRA

N79-15833# SRI International Corp., Arlington, Va.
INITIAL TESTING OF A DISEQUILIBRIUM ADJUSTMENT MECHANISM FOR CPE MACROECONOMETRIC MODELS Final Report
Daniel L. Bond Jun. 1978 58 p refs
(Contract SSC-77-B004691-000)
(AD-A059282; SSC-TN-5943-3) Avail: NTIS HC A04/MF A01 CSCL 05/3

Disequilibrium can be adjusted in macroeconometric models of centrally planned economies, by using a mechanism that ensures that certain balances between supply and demand in specific sectors, or for specific factors, are adhered to in the model's solution. Given an initial set of endogenously determined variable values, the search for balance is designed to minimize the deviation from these initial values, while at the same time satisfying the balancing constraints. Results of an initial test of the mechanism are also presented.
Author

N79-15834# Carnegie-Mellon Univ., Pittsburgh, Pa. Management Sciences Research Group.
AGGREGATION OF HETEROGENEOUS GOODS IN MODELS OF THE VON NEUMANN VARIETY
Radu Filimon May 1978 33 p refs Revised
(AD-A060653; MSRR-423-Rev) Avail: NTIS HC A03/MF A01 CSCL 05/3

The paper presents the aggregation of heterogeneous production into a homogenous one in an economy described by a General Equilibrium model of the von Neumann type (a KMT model and final demand). The resulting aggregated model will be of the von Neumann-Leontief type. Two cases will be considered, one in which the final demand is given by a vector of parameters, and another case which will have a final demand function.
GRA

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N79-15835# Committee on Appropriations (U. S. House).
DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT, INDEPENDENT AGENCIES APPROPRIATIONS FOR 1979. PART 1: NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Washington GPO 1978 1023 p refs Hearings before a subcomm. of the Comm. on Appropriations, 95th Congr., 2d Sess., 25 Jan. 1978
(GPO-23-738) Avail: Comm. on Appropriations

The role of NASA as an agency providing services to other government agencies, to the scientific community, to the public, and to other nations is reviewed in testimony presented to justify requests for appropriations for research and development, construction of facilities, and for research and program management. Topics covered include the space transportation system, space sciences; aeronautical research and technology; energy technology and its applications; remote sensing; data processing; and space industrialization. Funding requirements for the various programs and for the operation of NASA centers are analyzed.
A.R.H.

N79-15836# Committee on Commerce, Science, and Transportation (U. S. Senate).
NASA AUTHORIZATION FOR FISCAL YEAR 1979. PART 4: INDEX
Washington GPO 1978 119 p Hearings on S. 2527 before the Subcomm. on Sci., Technol., and Space of the Comm. on Commerce, Sci., and Transportation, 95th Congr., 2d Sess., 1978
(GPO-36-905) Avail: Subcomm. on Sci., Technol., and Space

Testimony presented on the Senate in support of NASA's budget requests for various programs is indexed.
A.R.H.

N79-15837# Committee on Commerce, Science, and Transportation (U. S. Senate).
SPACE LAW: SELECTED BASIC DOCUMENTS, SECOND EDITION
Washington GPO 1978 574 p refs Rept. for Comm. on Commerce, Sci., and Transportation, 95th Congr., 2d Sess., Dec. 1978
(GPO-32-231) Avail: SOD HC

This second edition of space law retains all of the documents of the first edition except the AEROSAT agreements negotiated since the publication of the first edition were added. The documents which are current as of December 1, 1978 are arranged under four sections: international space agreements; U.S. space law and policy; and previous committee reports.
A.R.H.

N79-15838# Committee on Science and Technology (U. S. House).
NASA AUTHORIZATION, 1979, VOLUME 1, PARTS 1, 2, AND 3 AND VOLUME 2, PARTS 1, 2
Washington GPO 1979 167 p Index for hearings on H.R. 10664 (superseded by H.R. 11401) before the Comm. on Sci.

and Technol., 95th Congr., 2d Sess., 1979
(GPO-38-083) Avail: Comm. on Sci. and Technol.

A subject and name index to the House hearings on NASA's request for appropriations to support research and development, construction of facilities, research and program management, and for other purposes is presented. A.R.H.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N79-15839# American Society of Civil Engineers, New York.
APPROPRIATE TECHNOLOGY IN WATER SUPPLY WASTE DISPOSAL: WORKSHOP AT THE ANNUAL CONVENTION AMERICAN SOCIETY OF CIVIL ENGINEERS
Oct. 1978 260 p refs Workshop held at Chicago, 16-20 Oct. 1978
(PB-288274/4; Preprint-3453) Avail: NTIS HC A12/MF A01 CSCL 13B

Topics covered include: historical thresholds in water supply and waste disposal; behavioral factors in selection of technologies; tradition and innovation in water use and reclamation; simplified water treatment plant design; intermediate service levels in water distribution; intermediate service levels in sanitation systems; environmental epidemiology and sanitation; cost-effective use of municipal wastewater treatment ponds; land treatment systems and the environment; systems of waste water management in Europe; and measuring the effects of man's wastes on the ocean. GRA

N79-15840# SRI International Corp., Menlo Park, Calif.
ASSESSMENT OF THE PASSENGER SHUTTLE SYSTEM (PSS) AT TAMPA INTERNATIONAL AIRPORT Final Report
A. M. Yen Dec. 1977 110 p refs
(Contract DOT-UT-70034)
(PB-285597/1; UMTA-IT-06-0135-77-4) Avail: NTIS HC A06/MF A01 CSCL 13B

The systems at Seattle-Tacoma International Airport, Fairlane Town Center, Houston Intercontinental Airport, Tampa International Airport, Walt Disney World, and King's Dominion Amusement Park were assessed. Engineering and operational data descriptive economic, system performance, and user perception data were obtained and the design, development, and implementation process was reviewed. The findings of an assessment of the Tampa International Passenger Shuttle System (PSS), an elevated, automated AGT system that provides passenger transit service between a landside terminal and remotely located airside terminals at the airport are presented. GRA

N79-15841# Cornell Univ., Ithaca, N. Y. Dept. of Natural Resources.
CULTURED DAPHNIDS AS A BIOLOGICAL WASTEWATER TREATMENT SYSTEM FOR OXIDATION POND EFFLUENT CLARIFICATION Final Report
Douglas G. Heimbuch, Sebastian Perretta, and John G. Nickum Jul. 1978 68 p refs
(Contract DI-14-34-0001-6033; DI-14-34-0001-7067; Contract DI-14-34-0001-7068)
(PB-285933/8; W78-11214; OWRT-A-065-NY(1)) Avail: NTIS HC A04/MF A01 CSCL 13B

The technical feasibility of culturing Daphnia magna in flowing water and their function as biological filters for removing algae from the effluent of simulated oxidation ponds, was demonstrated. Greatest daily increases in daphnid population biomass in 5.5 liter culture vessels were observed in populations receiving flows of low algal concentration (3 mg/1) and high flow rate (240 ml/min). The maximum four day average increase for three replicate populations of that treatment was 136 mg(dry weight)liter/day. Water leaving the culturing vessels of the 3 mg/1 x 240 ml/min treatment had significantly lower concentration of total nitrogen, total phosphorus, and volatile suspended solids than water entering the vessels; however, control vessels with no daphnid populations achieved similar reductions in total nitrogen, and total phosphorus. Concentrations of ammonia nitrogen and ortho-phosphate increased significantly in passing through culture vessels containing daphnid populations. GRA

N79-15842# Chicago Univ., Ill. Dept. of Economics.
ECONOMICS OF MUNICIPAL SOLID WASTE MANAGEMENT: THE CHICAGO CASE Final Report
G. Tolley, V. S. Hastings, and G. Rudzitis Aug. 1978 118 p refs Sponsored by EPA
(PB-286360/3; EPA-600/8-78-013) Avail: NTIS HC A06/MF A01 CSCL 13B

An extension of the theory of demand is provided, with specific application to collection and disposal services for household solid waste. The empirical investigation involving several socioeconomic variables (income, race, household size) repeated the analysis of an earlier study, using more recent (1970) Census data. The current findings supported the earlier results indicating a strong positive effect and a seasonal pattern for waste volume and income elasticity. There was less evidence of racial influence and household size on the quantity of solid waste for municipal collection and disposal. GRA

N79-15843# Charles River Associates, Inc., Boston, Mass.
ON THE DEVELOPMENT OF A THEORY OF TRAVELER ATTITUDE-BEHAVIOR INTERRELATIONSHIPS. VOLUME 1: INPUT TO THEORY DEVELOPMENT Final Report, Jan. 1977 - Jun. 1978
Aug. 1978 195 p
(Contract DOT-TSC-1326)
(PB-286663/0; CRA-347-Vol-1; DOT-TSC-RSPA-78-14-Vol-1)
Avail: NTIS HC A09/MF A01 CSCL 13B

Attitudinal and marketing concepts which could contribute to theory development were surveyed from the literature. Attitudes are divided into three components in order to better understand how they relate to traveler behavior. Hierarchical and multiattribute models are explicitly considered. It is recognized that not all travelers are identical, and market segmentation is an aspect of modeling orientation designed to account for differences between groups of travelers. A tentative model framework is presented along with an overview of how to quantitatively evaluate variations within the framework. Data collection considerations that support quantitative analyses of traveler attitude-behavior interrelationships are reviewed. GRA

N79-15844# Charles River Associates, Inc., Boston, Mass.
ON THE DEVELOPMENT OF A THEORY OF TRAVELER ATTITUDE-BEHAVIOR INTERRELATIONSHIPS. VOLUME 2: THEORETICAL AND EMPIRICAL FINDINGS Final Report, Jan. 1977 - Jun. 1978
Aug. 1978 246 p refs
(Contract DOT-TSC-1326)
(PB-286664/8; CRA-347-Vol-2; DOT-TSC-RSPA-78-14-Vol-2)
Avail: NTIS HC A11/MF A01 CSCL 13B

The structure of traveler attitude-behavior interrelationships is examined for two transport modes, buses and carpools, over three different datasets. Among the major findings are that traveler attitudes influence behavior toward transport alternatives and that traveler attitudes and behavior mutually affect each other. Various theoretical tensions of this work are described. A new quantitative procedure for assessing differences between travel market segments is developed and implemented. The relevance of the modeling orientation to transport system design and policy analysis is noted. Some implications of the modeling approach for data collection efforts are also noted. GRA

N79-15845# Charles River Associates, Inc., Boston, Mass.
ON THE DEVELOPMENT OF A THEORY OF TRAVELER ATTITUDE-BEHAVIOR OF INTERRELATIONSHIPS. VOLUME 3: EXECUTIVE SUMMARY; OVERVIEW OF METHODS, RESULTS, AND CONCLUSIONS Final Report, Jan. 1977 - Jun. 1978
Aug. 1978 41 p refs
(Contract DOT-TSC-1326)

(PB-286665/5; CRA-347-Vol-3; DOT-TSC-RSPA-78-14-Vol-3) Avail: NTIS HC A03/MF A01 CSCL 13B

A summary of project methods and achievements as evidenced by project reports serves as an introduction of theoretical considerations which guided the study. Various attitudinal components are identified and defined. Multiattribute models., hierarchical models, and market segmentation, are discussed, and structural equations are offered as a basis for appreciating theoretical and empirical findings. Selected data are presented to clarify the nature of traveler attitude-behavior interrelationships. The relevance of study findings to traveler attitude-behavior theory and transport policy analysis is noted. GRA

N79-15846# Voorhees (Alan M.) and Associates, Inc., McLean, Va.

AUTO RESTRICTED ZONE/MULTI-USER VEHICLE SYSTEM STUDY. VOLUME 1: AUTO RESTRICTED ZONES: BACKGROUND AND FEASIBILITY Final Report, Jul. 1975 - Dec. 1977

William S. Herald Dec. 1977 184 p refs Prepared in cooperation with Cambridge Systematics, Inc., Mass. and Moore-Heder Architects, Cambridge, Mass.

(Contract DOT-TSC-1057)

(PB-286313/2; UMTA-VA-06-0042-78-1) Avail: NTIS HC A07/MF A01; also available in set of 9 reports HC E20 as PB-286312-SET CSCL 13B

The underlying characteristic of an auto restricted zone (ARZ) as discussed in this study is that of a district or zone distinguished by a higher degree of control over vehicular traffic than the surrounding area. The report discusses techniques for ARZ which were identified and categorized as physical, operational, economic, and regulatory control measures. The investigation of existing experience with ARZ focuses on U.S. cities and on European cities where the concept is most advanced, such as in Copenhagen, Amsterdam and Vienna, and discusses its similarities and differences. A number of key factors are identified for its successful implementation. GRA

N79-15847# Voorhees (Alan M.) and Associates, Inc., McLean, Va.

AUTO RESTRICTED ZONE/MULTI-USER VEHICLE SYSTEM STUDY. VOLUME 2: MULTI-USER VEHICLE SYSTEMS: FEASIBILITY ASSESSMENT Final Report, Jul. 1975 - Dec. 1977

William S. Herald Dec. 1977 105 p refs Prepared in cooperation with Cambridge Systematics, Inc., Mass.

(Contract DOT-TSC-1057)

(PB-286314/0; UMTA-VA-06-0042-78-2) Avail: NTIS HC A06/MF A01; also available in set of 9 reports HC E20 as PB-286312-SET CSCL 13B

Volume 2 documents the results of an investigation into the feasibility of Multi-User Vehicle Systems (MUVS) as a mode of urban transportation. The goals and objectives of MUVS are to: (1) alleviate congestion and improve traffic flow; (2) increase mobility; (3) provide an additional choice of mode; (4) reduce air pollution from vehicle emissions; (5) reduce noise; (6) conserve energy; and (7) reduce land requirements for parking. A detailed examination of a MUVS as a Central Business District (CBD) circulation service in Amsterdam and in Montpellier, France is presented. Various characteristics of each system are identified and compared. GRA

N79-15848# Voorhees (Alan M.) and Associates, Inc., McLean, Va.

AUTO RESTRICTED ZONE/MULTI-USER VEHICLE SYSTEM STUDY. VOLUME 3: AUTO RESTRICTED ZONES: PLANS FOR FIVE CITIES Final Report, Jul. 1975 - Dec. 1977

William S. Herald Dec. 1977 257 p Prepared in cooperation with Cambridge Systematics, Inc., Mass. and Moore-Heder Architects, Cambridge, Mass.

(Contract DOT-TSC-1057)

(PB-286315/19; UMTA-VA-06-0042-78-3) Avail: NTIS HC A12/MF A01; also available in set of 9 reports HC E20 as PB-286312-SET CSCL 13B

The application of some of the auto restricted zones (ARZ) techniques to downtown areas of five U.S. cities: Boston; Burlington; Memphis; Providence; and Tucson is discussed. Emphasis was on tailoring an ARZ plan to each specific urban environment rather than imposing a preselected strategy. The process began with a systematic examination of the existing downtown infrastructure and current plans and projects already underway were also assessed for impact toward ARZ planning. GRA

N79-15849# Voorhees (Alan M.) and Associates, Inc., McLean, Va.

AUTO RESTRICTED ZONE/MULTI-USER VEHICLE SYSTEM STUDY. VOLUME 4: SITE SELECTION METHODOLOGY Final Report, Jul. 1975 - Dec. 1977

William S. Herald Dec. 1977 72 p Prepared in cooperation with Cambridge Systematics, Inc., Mass. and Moore-Heder Architects, Cambridge, Mass.

(Contract DOT-TSC-1057)

(PB-286316/5; UMTA-VA-06-0042-78-4) Avail: NTIS HC A04/MF A01; also available in set of 9 reports HC E20 as PB-286312-SET CSCL 13B

Volume 4 presents methodology followed in the selection of sites for auto restricted zones (ARZ) demonstrations. Of more than 75 applicants, five cities were selected for participation: Boston; Burlington; Memphis; Providence; and Tucson. The report includes the design of site specific programs to demonstrate this methodology in the five selected cities. The program was structured into seven major work elements which are outlined in the study. In the review process for each city, indicators of past performance, present commitment, future planning in institutional performance, transportation factors, and urban form and opportunities were examined. Six basic criteria were submitted to each city and are presented in this report. GRA

N79-15850# Voorhees (Alan M.) and Associates, Inc., McLean, Va.

AUTO RESTRICTED ZONE/MULTI-USER VEHICLE SYSTEM STUDY. TECHNICAL APPENDIX: BOSTON AUTO RESTRICTED ZONE STUDY Final Report, Jul. 1975 - Dec. 1977

William S. Herald Dec. 1977 155 p Prepared in cooperation with Cambridge Systematics, Inc., Mass., Moore-Heder Architects, Cambridge, Mass., and Kearney (A. T.) and Co., Inc., Chicago, Ill.

(Contract DOT-TSC-1057)

(PB-286317/3; UMTA-VA-06-0042-78-5) Avail: NTIS HC A08/MF A01 CSCL 13B

A proposal for an auto restricted zone (ARZ) and revised circulation patterns in downtown Boston is reported. In the City of Boston, the main problems are summarized as congestion, conflict of pedestrian and traffic, and confusion, rather than a lack of basic vitality. To remedy the current imbalance of pedestrian versus auto use, and to reduce the prevailing congestion in the older downtown traffic congestion was studied. The need to eliminate these problems, to create an appropriate environment for the existing or potential activities, and to improve connections among major activity areas are the basic factors for an Urban Design Plan. The goal for undertaking this proposed ARZ plan is to encourage the continued physical and economic revitalization of downtown Boston. GRA

N79-15851# Voorhees (Alan M.) and Associates, Inc., McLean, Va.

AUTO RESTRICTED ZONE/MULTI-USER VEHICLE SYSTEM STUDY. TECHNICAL APPENDIX: BURLINGTON AUTO RESTRICTED ZONE STUDY Final Report, Jul. 1975 - Dec. 1977

William S. Herald Dec. 1977 128 p Prepared in cooperation with Cambridge Systematics, Inc., Mass., Moore-Heder Architects, Cambridge, Mass. and Kearney (A. T.), Inc., Chicago, Ill.

(Contract DOT-TSC-1057)

(PB-286318/1; UMTA-VA-06-0042-78-6) Avail: NTIS HC A07/MF A01; also available in set of 9 reports HC E20 as PB-286312-SET CSCL 13B

A proposal for an auto restricted zone (ARZ) for the City of Burlington is examined. The City is faced with increased competition from a proposal for a major suburban shopping mall, as well as internal competition from a recently completed shopping arcade in the downtown area. This concern has culminated in the current proposal for construction of a 4-block pedestrian mall. A further issue facing the City is the quality of transit

facilities in the downtown. Several of Burlington's earlier Urban Design Plans now comprise the main urban design components of the proposed ARZ plan. Four existing characteristics were assessed to test potential of an ARZ. The Urban Design Plan consists of two elements: a circulation framework and a street improvement program. These elements are described in detail in the text. GRA

N79-15852# Voorhees (Alan M.) and Associates, Inc., McLean, Va.
AUTO RESTRICTED ZONE/MULTI-USER VEHICLE SYSTEM STUDY. TECHNICAL APPENDIX: MEMPHIS AUTO RESTRICTED ZONE STUDY Final Report, Jul. 1975 - Dec. 1977
William S. Herald Dec. 1977 184 p Prepared in cooperation with Cambridge Systematics, Inc., Mass., Moore-Heder Architects, Cambridge, Mass. and Kearney (A. T.), Inc., Chicago, Ill.
(Contract DOT-TSC-1057)
(PB-286319/9; UMTA-VA-06-0042-78-7) Avail: NTIS HC A09/MF A01; also available in set of 9 reports HC E20 as PB-286312-SET CSCL 13B

Analysis, data and supplementary information developed in the preparation of the Memphis auto restricted zone (ARZ) Demonstration Plan are presented. The approach taken in planning the circulation framework for the Memphis ARZ was somewhat different than that used in the other cities. Memphis had recently implemented a major change in its downtown circulation system by closing ten blocks and creating the Mid-America Mall. The Mall is active at midday during the week, but the evenings and weekends are quiet. Selective and modest additions could extend the Mall to a larger district, provide better facilities for the now disadvantaged transit riders, and encourage development projects that could improve street environment and support conversion of now-vacant buildings. GRA

N79-15853# Voorhees (Alan M.) and Associates, Inc., McLean, Va.
AUTO RESTRICTED ZONE/MULTI-USER VEHICLE SYSTEM STUDY. TECHNICAL APPENDIX: PROVIDENCE AUTO RESTRICTED ZONE STUDY Final Report, Jul. 1975 - Dec. 1977
William S. Herald Dec. 1977 207 p Prepared in cooperation with Cambridge Systematics, Inc., Mass., Moore-Heder Architects, Cambridge, Mass., and Kearney (A. T.), Inc., Chicago, Ill.
(Contract DOT-TSC-1057)
(PB-286320/7; UMTA-VA-06-0042-78-8) Avail: NTIS HC A10/MF A01; also available in set of 9 reports HC E20 as PB-286312-SET CSCL 13B

Technical analysis, data and supplementary information developed in the preparation of the Providence auto restricted zone (ARZ) demonstration plan are presented. Several existing urban design factors are critical to assess the potential for an ARZ in Providence: pedestrian environment; connections between downtown districts; quality of transit environment; historical quality and development potential; quality of economic environment; and management of public spaces. These issues are discussed in the text and the urban design proposals address these as problems that the ARZ should help resolve. GRA

N79-15854# Voorhees (Alan M.) and Associates, Inc., McLean, Va.
AUTO RESTRICTED ZONE/MULTI-USER VEHICLE SYSTEM STUDY. TECHNICAL APPENDIX: TUCSON AUTO RESTRICTED ZONE STUDY Final Report, Jul. 1975 - Dec. 1977
William S. Herald Dec. 1977 162 p Prepared in cooperation with Cambridge Systematics, Inc., Mass., Moore-Heder Architects, Cambridge, Mass., and Kearney (A. T.), Inc., Chicago, Ill.
(Contract DOT-TSC-1057)
(PB-286321/5; UMTA-VA-06-0042-78-9) Avail: NTIS HC A08/MF A01; also available in set of 9 reports HC E20 as PB-286312-SET CSCL 13B

A proposal for the preparation of an auto restricted zone (ARZ) in Tucson is examined. In order to revitalize the downtown, the City plans include reinforcement of the public transit system, construction of a major private office building and a public library, studies for rehabilitation of in-town historic residential neighborhoods, and attempts to attract new residential development downtown. GRA

N79-15855# BioTechnology, Inc., Falls Church, Va.
URBAN INTERSECTION IMPROVEMENTS FOR PEDESTRIAN SAFETY. VOLUME 1: EXECUTIVE SUMMARY Final Report, Jun. 1974 - Jun. 1977
Roger G. Petzold Dec. 1977 29 p 5 Vol.
(Contract DOT-FH-11-8533)
(PB-286497/3; FHWA/RD-77/146-Vol-1) Avail: NTIS HC A03/MF A01; also available in set of 5 reports HC E15 as PB-286496-SET CSCL 13B

Problems associated with pedestrian-vehicle interactions at intersections, countermeasure concepts that would reduce these problems, and the most desirable countermeasures to determine their effectiveness were examined. Alternatives to full signalization at pedestrian crossings was also studied. GRA

N79-15856# BioTechnology, Inc., Falls Church, Va.
URBAN INTERSECTION IMPROVEMENTS FOR PEDESTRIAN SAFETY. VOLUME 2: IDENTIFICATION OF SAFETY AND OPERATIONAL PROBLEMS AT INTERSECTIONS Final Report, Jun. 1974 - Jun. 1977
H. D. Robertson, W. G. Berger, and R. F. Pain Dec. 1977 127 p refs 5 Vol.
(Contract DOT-FH-11-8533)
(PB-286498/1; FHWA/RD-77/143-Vol-2) Avail: NTIS HC A07/MF A01; also available in set of 5 reports HC E15 as PB-286496-SET CSCL 13B

The safety and operational problems associated with the interaction of pedestrians and vehicles at intersections were studied. Both signalized and nonsignalized intersections were investigated. Four sources of information were used to define problems and uncover implications for countermeasure concepts. These sources included: accident data, expert opinion, behavioral observations, and conceptual investigations. GRA

N79-15857# BioTechnology, Inc., Falls Church, Va.
URBAN INTERSECTION IMPROVEMENTS FOR PEDESTRIAN SAFETY. VOLUME 3: SIGNAL TIMING FOR THE PEDESTRIAN Final Report, Jun. 1974 - Jun. 1977
C. M. Abrams and S. A. Smith Dec. 1977 181 p refs Prepared by JHK and Associates 5 Vol.
(Contract DOT-FH-11-8533)
(PB-286499/9; FHWA/RD-77/144-Vol-3) Avail: NTIS HC A09/MF A01; also available in set of 5 reports HC E15 as PB-296496-SET CSCL 13B

The final results of the signal timing research are presented. Improvements in the timing of pedestrian traffic signals are recommended both to maximize safety and to minimize delay. Specifically, the elements covered include timing for a combined pedestrian-vehicular interval. Minimum WALK time, minimum clearance interval, and allocation of excess pedestrian time are discussed along with early and late release of pedestrians with respect to vehicles, scramble pedestrian timing, and signal phasing for the partial crossing of wide, channelized streets. Other areas of pedestrian signal research include time-of-day adjustments of pedestrian signal timing, application of correction factors to the Highway Capacity Manual based on vehicle and pedestrian activity levels, and general observations on pedestrian flow characteristics. GRA

N79-15858# BioTechnology, Inc., Falls Church, Va.
URBAN INTERSECTION IMPROVEMENTS FOR PEDESTRIAN SAFETY. VOLUME 4: PEDESTRIAN SIGNAL DISPLAYS AND OPERATION Final Report, Jun. 1974 - Jun. 1977
H. Douglas Robertson Dec. 1977 172 p refs 5 Vol.
(Contract DOT-FH-11-8533)
(PB-286500/4; FHWA/RD-77/145-Vol-4) Avail: NTIS HC A08/MF A01; also available in set of 5 reports HC E15 as PB-286496-SET CSCL 13B

Three evaluation studies were conducted. The first study was a controlled experiment to determine what differences existed between 'lunar' and 'clear' white WALK lenses in pedestrian signals. The findings indicated that 'clear' white had better target value, but that 'lunar' white was more readable for three of the four lighting conditions tested. The second study consisted of three experiments, two of which dealt with the clearance

interval display, while the third evaluated flashing versus steady WALK. The third study evaluated the concept of using symbolic pedestrian displays in place of the current word message display. The hand-walking man symbol was found to show a significant improvement over the standard WALK-DONT WALK display. GRA

N79-15859# BioTechnology, Inc., Falls Church, Va.
URBAN INTERSECTION IMPROVEMENTS FOR PEDESTRIAN SAFETY. VOLUME 5: EVALUATION OF ALTERNATIVES TO FULL SIGNALIZATION AT PEDESTRIAN CROSSINGS Final Report, Jun. 1974 - Jun. 1977
Roger G. Petzold and Ronald Nawrocki Dec. 1977 242 p refs 5 Vol.
(Contract DOT-FH-11-8533)
(PB-286501/2; FHWA/RD-77/146-Vol-5) Avail: NTIS HC A11/MF A01; also available in set of 5 reports HC E15 as PB-286496-SET CSCL 13B

Pedestrian crossings located at the intersection of a high-volume arterial street and a low-volume residential street were considered. Five alternatives were selected for field evaluation with the following traffic devices on the major and minor streets, respectively: sign and stop sign, flashing yellow signal and flashing red beacon, flashing green signal and stop sign, (Sg-44) signal and stop sign, and crossing guard with stop signs on the residential street. The five school-pedestrian crossing designs are compared with fully signalized control sites. The Crossing Guard, (Sg-44) Signal and Stop Sign, and Flashing Green Signal and Stop Sign were determined to have operating characteristics significantly more desirable than those of a fully signalized intersection. GRA

N79-15860# Bureau of Reclamation, Denver, Colo. Div. of General Research.
MATERIALS FOR OXYGENATED WASTEWATER TREATMENT PLANT CONSTRUCTION Final Report
H. K. Uyeda, B. V. Jones, T. E. Rutenbeck, and J. W. Kaakinen Jul. 1978 128 p refs
(Contract EPA-IAG-0187-D)
(PB-286417/1; EPA-600/2-78-136) Avail: NTIS HC A07/MF A01 CSCL 13B

Resistant materials for construction of waste water treatment plants using the oxygen activated sludge process were identified. Samples of a broad range of construction materials were exposed for periods up to 28 months in the aeration basins of three operating municipal waste water treatment plans. All three plans were using oxygen activated sludge processes during the exposure period. Materials exposed included metallics, portland cement concretes, and plastic and rubber materials. An economic analysis was also conducted to evaluate the impact of materials recommendations generated by the exposure testing. GRA

N79-15861# General Accounting Office, Washington, D. C.
SEWAGE SLUDGE--HOW DO WE COPE WITH IT? Report to the Congress
25 Sep. 1978 49 p
(PB-286396/7; CED-78-152) Avail: NTIS HC A03/MF A01 CSCL 13B

Problems municipalities face in selecting and implementing sludge management systems that dispose of sludge in a safe, beneficial, and cost-effective manner and actions the Federal Government should take to help them were addressed. Sewage sludge disposal is a growing problem because the Nation's sludge volume is increasing dramatically; it is expected to double in size by 1987. At the same time, certain sludge disposal methods are being phased out, and use of others is being restricted. GRA

N79-15862# American Public Works Association, Chicago, Ill.
THE SWIRL PRIMARY SEPARATOR: DEVELOPMENT AND PILOT DEMONSTRATION Final Report
Richard H. Sullivan, Morris M. Cohn, James E. Ure, Fred Parkinson, and G. Galiana Aug. 1978 216 p
(Contract EPA-68-03-0272; Grant EPA-S-803157)
(PB-286339/7; APWA-73-3; EPA-600/2-78-122) Avail: NTIS HC A10/MF A01 CSCL 13B

The swirl concentrator principle was studied for use in sewer overflows and municipal wastewater. A hydraulic model with synthetic wastewater and a mathematical model were both used to arrive at an optimized configuration and a design basis. The design was then tested under actual wet- and dry-weather flow conditions using a large scale, 1.137 cu m/d (0.3 mgd) pilot. Evaluations confirmed the accuracy of the design developed under the model studies. The model and pilot studies indicated that the device could achieve 30 to 50 percent settleable solids removal efficiency for flows of less than 22 l/sec at costs comparable to, or less than, conventional treatment units. Overflow rates of two to three times that of conventional units make possible the saving. GRA

N79-15863# Massachusetts Inst. of Tech., Cambridge. Center for Policy Alternatives.
GOVERNMENT INVOLVEMENT IN THE INNOVATION PROCESS: A CONTRACTOR'S REPORT TO THE OFFICE OF TECHNOLOGY ASSESSMENT
Aug. 1978 75 p refs Sponsored by Office of Technology Assessment
(PB-286545/9; OTA-R-73; LC-78-600102) Avail: NTIS HC A04/MF A01 CSCL 05A

The major factors that currently influence the process of introducing new goods and services to the user are examined. These factors include: incentives and funding for basic research; tax, patent, procurement, and antitrust policies; regulations; size, sector, and locale of the business; subsidies; inflation rate; available technical, marketing, and management skills; credit; and the formation of capital. The activities of five industrialized nations in the support of science and technology are described. GRA

N79-15864# Hydrocarbon Research, Inc., Lawrenceville, N. J.
DEMETALLIZATION CATALYST TESTS ON HEAVY RESIDUAL OILS Final Report, Feb. 1975 - Jan. 1977
P. Maruhnic, G. Nongbri, William J. Rhodes, V. V. Manshilin, Yu. K. Vail, B. A. Lipkind, and A. V. Agafonov Jun. 1978 86 p refs Prepared in cooperation with All-Union Sci. Res. Inst. of Oil Refining, Moscow; and Industrial Environ. Res. Lab., Research Triangle Park, N. C.
(Contract EPA-68-02-0293)
(PB-285937/9; EPA-600/7-78-119) Avail: NTIS HC A05/MF A01 CSCL 07A

Results of a cooperative project between the U. S. and the USSR to exchange technology on the demetallization step of an overall process to produce low sulfur fuel oil from heavy petroleum residue are presented. Graphs are included for each aging test showing the degree of demetallization and desulfurization and the rate of catalyst deactivation. Fresh and used catalyst analyses are presented, along with detailed run summaries and product inspections. Each nation's molybdenum-impregnated catalyst exhibited about equal demetallization capability; however, the U.S. catalyst exhibited higher desulfurization capability during demetallization. GRA

N79-15865# North Carolina Water Resources Research Inst., Raleigh.
TRANSFER OF WATER RESOURCES KNOWLEDGE: AN ASSESSMENT Final Report
Neil S. Grigg 1 Jul. 1978 95 p refs
(PB-286132/6; UNC-WRRI-132; W78-11384; OWRT-T-0012(6709)(1)) Avail: NTIS HC A05/MF A01 CSCL 05A

Water resources knowledge transfer seeks to make best use of scientific and technical information in water management. It is an important process in water research management because its outcome determines the effectiveness of entire programs. The report contains an analysis of the problem in the water sector, a general overview of the technology transfer question, presentation of conceptual models for transfer, and recommendations for policy changes. The genesis of the report lies in the planning and organization of the Second International Conference on Transfer of Water Resources Knowledge. GRA

N79-15866# Briscoe, Maphis, Murray and Lamont, Inc., Boulder, Colo.
ACTION HANDBOOK: MANAGING GROWTH IN THE SMALL COMMUNITY Final Report
James A. Murray and William Lamont, Jr. Jul. 1978 317 p refs

(Contract EPA-68-01-3579)
(PB-286911/3; EPA-908/4-78-005) Avail: NTIS HC A14/MF A01 CSCL 13B

An overview of the community management process is given to assist the user in estimating how development of a certain type might affect the community's needs for various public services. Approaches to getting the community involved and organized are described along with a working model for community organizers. Community action and growth management are discussed for those closely involved in making government work to manage growth. GRA

N79-15867# SRI International Corp., Menlo Park, Calif.
ASSESSMENT OF THE AUTOMATICALLY CONTROLLED TRANSPORTATION (ACT) SYSTEM AT FAIRLANE TOWN CENTER Final Report
A. M. Yen, C. Henderson, M. Sakasita, M. Roddin, R. Cronin, and W. Siddiqee Dec. 1977 120 p refs
(Contract DOT-UT-70034)
(PB-286524/4; UMTA-IT-06-0135-77-2) Avail: NTIS HC A06/MF A01 CSCL 13F

An automatically controlled system for passenger transport in the Fairlane Town Center at Dearborn, Michigan was studied to: (1) obtain factual engineering and operational data;(2) obtain descriptive economic system performance, and user perception data; and (3) review the design, development, and implementation process. The findings are intended to establish the state of the art of automated guideway transit systems for ultimate use in planning, evaluating, producing and deploying. The approach used in the Fairlane assessment is described. The engineering systems and their operation, maintenance and reliability are evaluated. Passenger-oriented system performance; systems economics; and the development history are likewise examined. GRA

N79-15868# Transportation Research Board, Washington, D. C.
ENVIRONMENTAL CONSERVATION CONCERNS IN TRANSPORTATION: ENERGY, NOISE, AND AIR QUALITY
Damian J. Kulash, Carmen Difiglio, Philip S. Shapiro, Richard H. Pratt, and Charles A. Lave 1977 82 p refs
(PB-286550/9; TRB/TRR-648; ISBN-0-309-02677-6; LC-78-13538) Avail: NTIS HC A05/MF A01 CSCL 13F

Topics covered include: impact of mandatory fuel economy standards on automobile sales and fuel use; energy-saving potential of transit; rail rapid transit and energy; the adverse effects; energy-crisis travel behavior and the transportation planning process; potential energy savings resulting from a cessation of federal aid to urban highway construction; policy preferences for conservation of transportation energy in case of fuel shortage; traffic noise prediction comparative analysis of HIWAY, California and CALINE 2 line source dispersion models; Philadelphia air quality control development of criteria for reserving exclusive bus lanes; line source emissions modeling and use of traffic simulation in analysis of carbon monoxide pollution. GRA

N79-15869# Comsis Corp., Wheaton, Md.
TRAVEL ESTIMATION PROCEDURES FOR QUICK RESPONSE TO URBAN POLICY ISSUES Final Report
Arthur B. Sosslau, Amin B. Hassam, M. M. Carter, and G. V. Wickstrom Washington Transportation Research Board. Jun. 1978 77 p refs Sponsored by Federal Highway Admin. and Am. Assoc. of State Highway and Transportation Officials
(PB-286889/1; TRB/NCHRP/REP-186; ISBN-0-309-02774-8; LC-78-66459) Avail: NTIS HC A05/MF A01 CSCL 13B

The most significant issues confronting urban transportation agencies that require travel demand information are described. The data requirements to meet those issues are identified, and available planning techniques that can provide the needed data are documented. These techniques, more than 40 in all, were fully evaluated in terms of input requirements, types of output, potential applications, and complexity. A system was developed to allow users to quickly locate the technique needed for their specific purpose. GRA

N79-15870# Hoechst-Uhde Corp., Englewood Cliffs, N. J.
CHLOROLYSIS APPLIED TO THE CONVERSION OF CHLOROCARBON RESIDUES Final Report, Dec. 1976 - Mar. 1978
C. E. Shannahan, H. Weber, G. Hauptman, and N. Carduck Jul. 1978 65 p refs
(Contract EPA-68-03-2380)
(PB-285783/7; EPA-600/2-78-146) Avail: NTIS HC A04/MF A01 CSCL 07A

A program was initiated with the objective of determining the technical feasibility and economic viability of eliminating, within the United States, the discharge of large quantities of chlorocarbon residues which are harmful to the environment through the use of a German process (chlorolysis), which was used commercially on almost identical residues, to produce a saleable product. The technology selected and analyzed for this purpose is known as the Chlorolysis Process. In addition to its established basis chlorolysis also offers the advantage of handling a wide variety of chlorocarbon waste residues making it especially suitable for use in a regional plant. GRA

N79-15871# Regional Science Research Inst., Philadelphia, Pa.
CHARACTERISTICS OF SECONDARY MATERIALS MARKETS AND THEIR IMPLICATIONS FOR RESOURCE RECOVERY POLICY
Robert E. Coughlin, Thomas Plant, and Gene Steiker Mar. 1978 183 p refs
(Grant NSF AER-76-19115-A01)
(PB-286601/0; NSF/RA-780077) Avail: NTIS HC A09/MF A01 CSCL 11L

The regional econometric analysis of the wastepaper market and the interactive computer program for estimating potential supply of secondary materials are presented. The nature of supply and demand forces underlying scrapmarkets which determine the extent of resource recovery and the effectiveness of any public programs to encourage recycling industry were investigated. The paper industry, which has for many years included an important recycling component, provided the focus. An econometric analysis of the markets for scrap paper was completed which indicates the form of the relevant supply and demand relationships. A simple-to-use interactive computer model was developed for estimating the potential scrap supply generated within a given area for which data are available on population and on economic structure and employment. GRA

N79-15872# TRW, Inc., Redondo Beach, Calif.
COMPARATIVE COST ANALYSIS AND ENVIRONMENTAL ASSESSMENT FOR DISPOSAL OF ORGANOCHLORINE WASTES Final Task Report, May - Jun. 1978
C. C. Shih, J. E. Cotter, D. Dean, S. F. Paige, and E. P. Pulaski Aug. 1978 140 p refs
(Contract EPA-68-02-2613)
(PB-286095/5; EPA-600/2-78-190) Avail: NTIS HC A07/MF A01 CSCL 07A

The costs and environmental impacts associated with the disposal of liquid organochlorine wastes by land-based incineration, at-sea incineration, and chlorolysis are compared. At typical unit disposal costs of $80 to $91 per metric ton, at-sea incineration is the least costly option. Comparable costs are $181 to $212 per metric ton at a centralized landbased incinerator, and $134 to $158 per metric ton by the Hoechst-Uhde chlorolysis process if suitable feedstocks are available. Environmentally, maximum ground level concentrations of inorganic chlorine and organochlorine species and particulates emitted from land-based incinerators and chlorolysis are all several orders of magnitude lower than their respective Threshold Limit Values or are within air quality standards. GRA

N79-15873# National Training and Operational Technology Center, Cincinnati, Ohio.
OPERATIONAL CONTROL PROCEDURES FOR THE ACTIVATED SLUDGE PROCESS. PART 1: OBSERVATIONS. PART 2: CONTROL TESTS Final Report
Alfred W. West Mar. 1978 193 p Revised
(PB-286800/8; EPA-430/1-78-016-Pt-1/2) Avail: NTIS HC A09/MF A01 CSCL 13B

Activated sludge process procedures, based on sludge quality and solids inventory are described. The interpretation of process status and requirements from physical observations, and control tests used for process control are considered. Calculation procedures describe the calculations used with the control test

results to develop the necessary process status and control decision information and for the activated sludge process. The report provides an updated summary of the operational control procedures with new material on sludge quality and process control and expanded versions of return sludge flow control which considers most types of sludges encountered in actual practice. GRA

N79-15874# California State Dept. of Housing and Community Development, Sacramento.
TECHNICAL ASSISTANCE DEMONSTRATION PROGRAM TO NON-URBAN AREAS Final Report
Sep. 1978 98 p refs
(Grant EDA-07-6-01671)
(PB-286895/8; EDA-78-0128) Avail: NTIS HC A05/MF A01 CSCL 13B

Five nonurban communities in California were selected to receive technical assistance in overcoming severe economic problems. By working with local officials in the field, economic development opportunities were identified and seized. The communities selected were the cities of Anderson, Coachella, Fort Bragg, Hollister, and Oroville. GRA

N79-15888*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
TECHNOLOGY UTILIZATION
Charles C. Kubokawa *In its* Human Neurol. Develop. Nov. 1978 p 5-7 (For primary document see N79-15887 06-99)
Avail: NTIS HC A04/MF A01 CSCL 05A

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N79-15875*# California Univ., Berkeley.
INFRARED HETERODYNE SPECTROSCOPY FOR ASTRONOMICAL PURPOSES
C. H. Townes [1978] 6 p refs
(Grants NGL-05-003-272; NGR-05-003-452)
(NASA-CR-158052) Avail: NTIS HC A02/MF A01 CSCL 03A

Heterodyne infrared astronomy was carried out using CO2 lasers and some solid state tunable lasers. The best available detectors are mercury cadmium telluride photodiodes. Their quantum efficiencies reach values near 0.5 and in an overall system an effective quantum efficiency, taking into account optical losses and amplifier noise, of about 0.25 was demonstrated. Initial uses of 10 micron heterodyne spectroscopy were for the study of planetary molecular spectra. G.G.

N79-15876*# Lockheed Missiles and Space Co., Palo Alto, Calif.
CORRELATION TRACKING STUDY FOR METER-CLASS SOLAR TELESCOPE ON SPACE SHUTTLE Final Report
Robert C. Smithson and Theodore D. Tarbell 24 Jun. 1977 101 p refs
(Contract NAS5-23529)
(NASA-CR-159908; LMSC/D562493) Avail: NTIS HC A06/MF A01 CSCL 03A

The theory and expected performance level of correlation trackers used to control the pointing of a solar telescope in space using white light granulation as a target were studied. Three specific trackers were modeled and their performance levels predicted for telescopes of various apertures. The performance of the computer model trackers on computer enhanced granulation photographs was evaluated. Parametric equations for predicting tracker performance are presented. A.R.H.

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N79-15877# State Univ. of New York, Stony Brook. Inst. for Theoretical Physics.
THE ROLE OF NEUTRINOS AND ANTINEUTRINOS IN THE FORMATION AND COOLING OF NEUTRON STARS
G. E. Brown 1977 14 p refs Presented at the Conf. on the present Status of Week Interaction Phys., Bloomington, Ind., 16-17 May 1977
(Contract E(11-1)-3001)
(COO-3001-185) Avail: NTIS HC A02/MF A01

The supernova explosion, in which enough neutrinos should arise to fill every heart and neutrino detector near the subject, is discussed. The formation of a neutron star, from which neutrinos and antineutrinos should come copiously, especially in the early stages of cooling is developed. DOE

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance.* For space stations see *15 Launch Vehicles and Space Vehicles.*

N79-15878*# South Carolina Univ., Columbia. Coll. of Science and Mathematics.
INFRARED SPECTRA OF MOLECULES AND MATERIALS OF ASTROPHYSICAL INTEREST
James R. Durig Nov. 1978 52 p refs
(Grant NGL-41-002-003)
(NASA-CR-158060; QPR-45) Avail: NTIS HC A04/MF A01 CSCL 03B

The Raman spectra of gaseous, liquid and solid, and infrared spectra of gaseous and solid isopropylamine-d sub 0 and -d sub 2 was investigated between 4000 and 50 cm superscript -1. Differences between the spectrum of the solid phase and that of the fluid phases were interpreted in terms of an equilibrium between low energy s-trans and high energy gauche conformers, and a complete vibrational assignment was proposed for the s-trans conformer. The far infrared spectra of the gaseous compounds contained bands due to the asymmetric amino and coupled methyl torsions; the assignment of these bands was aided by observation of a number of two quantum transitions for each vibrational mode. The asymmetric potential functions were calculated, which resulted in values for the enthalpy differences between conformers in the gaseous phase of 446 and 523 callmole for the sub 0 -d and -d sub 2 compounds, respectively. The methyl torsional potential function of isopropyl-amine-d sub 0 was calculated which led to a value for the barrier height to internal rotation of the methyl rotors of 4.23 + or - 0.06 kcal/mole. Values for the ideal gas thermodynamic functions were calculated over a range of temperatures. Author

N79-15879*# Yale Univ., New Haven, Conn.
SOLAR WIND SPUTTERING EFFECTS IN THE MARTIAN ATMOSPHERE
C. C. Watson, P. K. Haff, and W. K. Kellogg (Calif. Inst. of Technol.) Jan. 1979 23 p refs
(Grant NGR-05-002-333; Contract EY-76-C-02-3074; Grants NSF PHYS-76-83685; EX-76-G-03-1305)
(NASA-CR-157864; LiAP-28) Avail: NTIS HC A02/MF A01 CSCL 03B

A Monte Carlo simulation of the sputtering of the upper atmosphere of Mars by the solar wind was performed. The calculated sputtering yields imply loss rates (molecules/cm

square - sec escaping the planet) for carbon dioxide, carbon, and oxygen of R(CO2) = 2.6 X 1000000/cm square - sec, R(C) = 6.6 X 1000000/cm square - sec, and R(O) = 7.7 X 1000000/cm - sec. The total mass loss by sputtering is only about 10% of that due to chemical and photo-chemical processes, but sputtering provides a major exospheric sink for carbon. The erosion process described here preferentially removes the lighter components of the atmosphere. Calculations based on a Monte Carlo simulation suggest that for a model atmosphere, 97% of the N2 and 33% of the CO2 originally present may have been sputtered away over 4.5 X 10 to the 9th power y. In the same length of time the (15)N/(14)N isotopic ratio for the bulk atmosphere would have increased by a factor 1.7. Author

N79-15880*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PLANETARY BENCHMARKS
Chauncy Uphoff, R. Staehle, M. Kobrick, R. Jurgens, H. Price, M. Slade, and D. Sonnabend 1 Dec. 1978 126 p refs
(Contract NAS7-100)
(NASA-CR-158071; JPL-Pub-78-94) Avail: NTIS HC A07/MF A01 CSCL 03B

Design criteria and technology requirements for a system of radar reference devices to be fixed to the surfaces of the inner planets are discussed. Offshoot applications include the use of radar corner reflectors as landing beacons on the planetary surfaces and some deep space applications that may yield a greatly enhanced knowledge of the gravitational and electromagnetic structure of the solar system. Passive retroreflectors with dimensions of about 4 meters and weighing about 10 kg are feasible for use with orbiting radar at Venus and Mars. Earth-based observation of passive reflectors, however, would require very large and complex structures to be delivered to the surfaces. For Earth-based measurements, surface transponders offer a distinct advantage in accuracy over passive reflectors. A conceptual design for a high temperature transponder is presented. The design appears feasible for the Venus surface using existing electronics and power components. A.R.H.

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N79-15881*# Texas Univ. at San Antonio. Center for Applied Research and Technology.
RESEARCH ON SOLAR-WIND AND MAGNETOSPHERIC ELECTRIC FIELDS AND PLASMAS Final Report, 30 Sep. 1977 - 30 Nov. 1978
James L. Burch 1978 47 p refs
(Grant NsG-5214)
(NASA-CR-158069) Avail: NTIS HC A03/MF A01 CSCL 03B

Attempts were made to determine the role of the interplanetary magnetic field in controlling: (1) particle acceleration processes in the earth's polar cap; (2) plasma convection patterns at high latitudes; and, (3) the topology of magnetic field lines in the earth's polar cusps. The primary result of the study on polar-cap particle acceleration regions was that they tend to occur in only one polar cap at a time, and that they occur in the hemisphere for which the magnetospheric tail-lobe field lines have solar-magnetospheric x components that are antiparallel to those of the interplanetary and tail-lobe magnetic field. Southward-directed interplanetary magnetic fields give rise to broad convection throats which cover several hours of local time across the dayside cleft. Under such conditions, solar-wind plasma is channeled efficiently through the polar cusps to populate the plasma mantle and dayside boundary layer. On the other hand, the appearance of strong northward components in the interplanetary magnetic field result in a very constricted throat, resulting in inefficient plasma entry at the cusps by diffusion processes. L.S.

N79-15882*# Lockheed Missiles and Space Co., Palo Alto, Calif.
REPORT ON MONITORING AND SUPPORT INSTRUMENTS FOR SOLAR PHYSICS RESEARCH FROM SPACELAB
Apr. 1978 71 p refs
(Contract NAS5-22368)
(NASA-CR-159909) Avail: NTIS HC A04/MF A01 CSCL 03B

The Quick Reaction and Special Purpose Facility Definition Team for Solar Physics Spacelab Payloads examined a variety of instruments to fulfill the following functions: (1) solar physics research appropriate to Spacelab, (2) correlative data for research in such fields as aeronomy, magnetospheric physics, ionospheric physics, meteorology and climatology, (3) target selection for activity alert monitoring and (4) pointing accuracy monitoring of Spacelab platforms. In this examination the team accepted a number of restrictions and qualifications: (1) the cost of such instruments must be low, so as not to adversely impact the development of new, research class instrumentation in the early Spacelab era; (2) the instruments should be of such a size that they each would occupy a small fraction of a pointing system, and (3) the weight and power consumption of the instruments should also be small. With these restrictions, the instruments chosen are: the visible light telescope and magnetograph, the extreme-ultraviolet telescope, and the solar irradiance monitor. L.S.

N79-15883# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NUMBER 408, AUGUST 1978, PART 1: PROMPT REPORTS. DATA FOR JULY 1978, JUNE 1978
Helen E. Coffey Aug. 1978 173 p 2 Vol.
(PB-287440/2; SGD-408-Pt-1; NOAA-78091903-Pt-1) Avail: NTIS HC A08/MF A01 CSCL 04A

Data on daily solar indices, solar flares, solar radio waves, solar X-ray radiation, coronal holes, solar wind measurements, inferred IP magnetic field polarities, mean solar magnetic field, spacecraft observations, Boulder geomagnetic substorm log, and energetic solar particles are reported. Data on daily solar activity center, sudden ionospheric disturbances, solar X-ray radiation, solar radio waves, cosmic rays, geomagnetic indices, and radio propagation indices are provided. GRA

N79-15884# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NUMBER 408, AUGUST 1978, PART 2: COMPREHENSIVE REPORTS. DATA FOR FEBRUARY 1978 - JANUARY 1978 AND MISCELLANEA
Helen E. Coffey Aug. 1978 87 p 2 Vol.
(PB-287441/0; SGD-408-Pt-2; NOAA-78091904-Pt-2) Avail: NTIS HC A05/MF A01 CSCL 04A

Data on active regions, synoptic solar maps, solar flares, solar radio waves, energetic solar particles and plasma, synoptic chart, abbreviated calendar record, regional flare index, geomagnetic indices, and energetic solar particles and plasma are reported. GRA

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N79-15885*# Tennessee Univ., Knoxville. Dept. of Physics and Astronomy.
LINE IDENTIFICATION AND LIFETIME MEASUREMENTS IN THE XUV AND SOFT X-RAY REGIONS Final Report
Ivan A. Sellin Jan. 1979 22 p refs
(Grant NsG-7049)
(NASA-CR-157863) Avail: NTIS HC A02/MF A01 CSCL 03B

A summary of the data acquired concerning line identification and lifetime measurements in the xuv and soft X-ray regions for a variety of both resonance transitions and forbidden transitions in ions of astrophysical interest is provided. Particular attention is called to a few papers which appeared in the Astrophysical Journal. These are of special relevance to specific astrophysical

data needs. The many experiments completed in areas related to but somewhat outside the confines of the project title are mentioned. L.S.

N79-15886*# Analytical Mechanics Associates, Inc., Seabrook, Md.
DATA ANALYSIS TO SEPARATE PARTICLES OF DIFFERENT SPEED REGIMES AND CHARGES
Henry Wolf Jul. 1977 11 p ref
(Contract NAS5-22386)
(NASA-CR-159916; AMA-77-13) Avail: NTIS HC A02/MF A01 CSCL 03B

Although the instruments on the lunar ejecta and meteorite experiment (LEAM) and the Pioneer 8 and 9 space probes were essentially similar, a comparison of their results indicates that different sets of particles caused the different responses. On Pioneer, the events were caused by the impact of cosmic dust, the so-called beta particles expelled from the vicinity of the sun by solar radiation pressure, augmented by extremely high energy but definitely identifiable interstellar grains. On the moon, the events were due to the impact of slowly moving, highly charged lunar dust being propelled electrostatically across the terminator. Both theoretical analysis and experimental testing confirming these conclusions are discussed. A.R.H.

99 GENERAL

N79-15887*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
HUMAN NEUROLOGICAL DEVELOPMENT: PAST, PRESENT AND FUTURE
Ralph Pelligra, ed. Nov. 1978 60 p refs Symp. held at Moffett Field, Calif., 18 May 1978; sponsored in part by Inst. for the Achievement of Human Potential, Philadelphia, Pa. Original contains color illustrations
(NASA-CP-2063; A-7630) Avail: NTIS HC A04/MF A01 CSCL 06P

Neurological development is considered as the major human potential. Vision, vestibular function, intelligence, and nutrition are discussed as well as the treatment of neurological disfunctions, coma, and convulsive seizures. For individual titles, see N79-15888 through N79-15897.

N79-15888*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
TECHNOLOGY UTILIZATION **c85**
Charles C. Kubokawa *In its* Human Neurol. Develop. Nov. 1978 p 5-7 (For primary document see N79-15887 06-99)
Avail: NTIS HC A04/MF A01 CSCL 05A

NASA developed technologies were used to tackle problems associated with safety, transportation, industry, manufacturing, construction and state and local governments. Aerospace programs were responsible for more innovations for the benefit of mankind than those brought about by either major wars, or peacetime programs. Briefly outlined are some innovations for manned space flight, satellite surveillance applications, and pollution monitoring techniques. G.G.

N79-15889*# Institutes for the Achievement of Human Potential, Philadelphia, Pa. Institute of Man.
REMINISCENCES, OBSERVATIONS, AND EXPECTATIONS
Raymond A. Dart *In* NASA. Ames Res. Center Human Neurol. Develop. Nov. 1978 p 11-16 refs (For primary document see N79-15887 06-99)
Avail: NTIS HC A04/MF A01 CSCL 06P

African fossil bones were used to reconstruct the history of human development from the ape-man to Homo habilis. G.G.

N79-15890*# Institutes for the Achievement of Human Potential, Philadelphia, Pa. Inst. for Clinical Investigation.
THE CHILD IN COMA **c52**
Edward B. LeWinn *In* NASA. Ames Res. Center Human Neurol. Develop. Nov. 1978 p 17-19 (For primary document see N79-15887 06-99)
Avail: NTIS HC A04/MF A01 CSCL 06E

Children in coma continue to pose medical, social, economic, ethical, moral, and legal problems. Modern life-support technology has aggravated these problems. Coma is viewed as a pathological state of unconsciousness from which the patient has not achieved arousal, and which calls for vigorous action to help him regain consciousness. There are two variables that have an especially important bearing on the ability to achieve arousal. These are: the character of the brain injury that caused the coma, and environmental factors that affect the patient after the injury.G.G.

N79-15891*# Nassau Hospital, Mineola, N. Y. Coma Recovery Inst.
COMA RECOVERY **c52**
Mihai D. Dimancescu *In* NASA. Ames Res. Center Human Neurol. Develop. Nov. 1978 p 21-23 (For primary document see N79-15887 06-99)
Avail: NTIS HC A04/MF A01 CSCL 06E

Arousal from coma is defined as a function of the reticular activating system that is located between the spinal cord and the diencephalon core of the brain stem. This system receives information from all the sensory functions of the body for distribution to the various parts of the cortex in order to maintain normal activities. Multimodal, neurosensory stimulation techniques are outlined that are designed to help the patient recover from the comatose state. G.G.

N79-15892*# Institutes for the Achievement of Human Potential, Philadelphia, Pa. Inst. for Clinical Investigation.
THE CONTROL AND PREVENTION OF SEIZURES IN CHILDREN, A DEVELOPMENTAL AND ENVIRONMENTAL APPROACH **c52**
Edward B. LeWinn *In* NASA. Ames Res. Center Human Neurol. Develop. Nov. 1978 p 25-27 ref (For primary document see N79-15887 06-99)
Avail: NTIS HC A04/MF A01 CSCL 06E

The clinical effectiveness of neurophysiological and developmental factors in controlling and preventing seizure mechanisms is detailed. It is shown that as cortical control advances with maturation, it requires increasingly severe environmental adversity to release this residual defensive reflex mechanism. Administration of anticonvulsant drugs is discouraged because of possible undesirable neuronal effects on the very young brain. G.G.

N79-15893*# San Jose State Univ., Calif.
VESTIBULAR INFLUENCES ON OTHER SENSORY AND MOTOR PROCESSES **c52**
Brant Clark *In* NASA. Ames Res. Center Human Neurol. Develop. Nov. 1978 p 29-33 (For primary document see N79-15887 06-99)
Avail: NTIS HC A04/MF A01 CSCL 06P

Vestibular effects on perceptual and motor processes are widespread. It is shown that gyrovisual modulation may take three forms: (1) gyrovisual inhibition (monitoring tasks and spurious motion); (2) gyrovisual facilitation (tracking); and (3) gyrovisual conflict (motion sickness and disorientation in flight). G.G.

N79-15894*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
VISION **c52**
Richard F. Haines *In its* Human Neurol. Develop. Nov. 1978 p 35-45 Original contains color illustrations (For primary document see N79-15887 06-99)
Avail: NTIS HC A04/MF A01 CSCL 06P

Visual input methods are considered for the therapeutic treatment of autistic and brain-damaged patients, and to provide a controlled stress environment for visual perception problems. G.G.

N79-15895*# Linus Pauling Inst. for Science and Medicine, Menlo Park, Calif.
ORTHOMOLECULAR ENHANCEMENT OF HUMAN DEVELOPMENT **c52**
Linus Pauling *In* NASA. Ames Res. Center Human Neurol. Develop. Nov. 1978 p 47-51 (For primary document see N79-15887 06-99)
Avail: NTIS HC A04/MF A01 CSCL 06P

The importance of molecules introduced into the human body by the way of foods is emphasized. Examples of orthomolecular therapy are given that range from the control of epileptic seizures, the therapy of mental illness, to the prevention of the common cold. G.G.

N79-15896*# Institutes for the Achievement of Human Potential, Philadelphia, Pa.
INTELLIGENCE **c53**
Glenn Doman, Janet Doman, Susan Aisen, Miki Nakayachi, Gail Engebretson, Conceicao DeSousa, and Bruce Hagy *In* NASA. Ames Res. Center Human Neurol. Develop. Nov. 1978 p 53-58 (For primary document see N79-15887 06-99)
Avail: NTIS HC A04/MF A01 CSCL 05J

Genetic and environmental facts in the development of human intelligence are discussed. Intelligence is considered to be the major portion of the human potential. G.G.

N79-15897*# Trans World Airlines, Inc., Kansas City, Mo.
DEVELOPMENT OPPORTUNITIES IN THE SPACE ENVIRONMENT **c52**
Richard D. Norton *In* NASA. Ames Res. Center Human Neurol. Develop. Nov. 1978 p 59-63 (For primary document see N79-15887 06-99)
Avail: NTIS HC A04/MF A01 CSCL 06P

Human physiological changes are outlined which occur in a space environment. It is shown that flexibility and adaptability are keys to maximizing neurological and body-functions for purposes of life support and health under reduced gravity conditions. Controlled manipulation of gravity in a space environment could reduce some aging problems by delaying the physical collapse of the skeleton, the cardiovascular system, and of tissues and organs. G.G.

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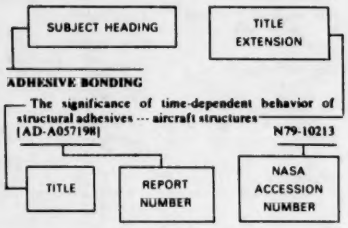

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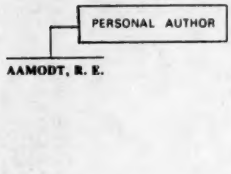

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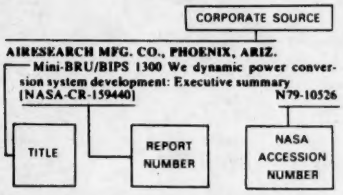

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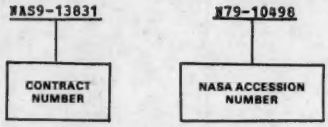

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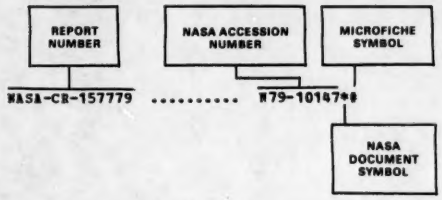

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